# DMP248 Dewpoint Transmitter

# *OPERATING MANUAL*

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VAISALA

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# CHAPTER 1 GENERAL INFORMATION

## Safety

Throughout the manual important instructions regarding the safety considerations are focused as follows.

| | |
|---|---|
| **WARNING** | Warning denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury to or death of personnel. |

| | |
|---|---|
| **CAUTION** | Caution denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. |

| | |
|---|---|
| **NOTE** | Note highlights important information. It calls attention to an essential procedure, practice, condition or the like. |

## Warranty

Vaisala issues a guarantee for the material and workmanship of this product under normal operating conditions for one (1) year from the date of delivery. Exceptional operating conditions, damage due to careless handling and misapplication will void the guarantee.

# CHAPTER 2 PRODUCT DESCRIPTION

## General characteristics

The DMP248 transmitter is a microprocessor-based instrument for the measurement of dewpoint temperature in low humidities. The transmitter measures other quantities as well: relative humidity, temperature and ppm concentration (dry). When the dewpoint temperature is below 0 °C, the transmitter calculates the frostpoint instead of the dewpoint. The dewpoint output can be scaled freely, for example, dewpoint -40...+20 °C can be set to correspond to 0...1 V. The DMP248 transmitter has two analogue outputs and can be connected to a serial bus via the RS 232C interface or optionally through an RS 485/422 serial module or a current loop module.

The transmitter can be configured in many ways. It can have either a blank cover or a cover with a local display and keypad with which the user can operate the transmitter. The power supply voltage can be selected from three alternatives (24 VDC/VAC, 115 VAC, 230 VAC). Two analogue output signals are selected from the measured quantities; the signals can be scaled and the measurement ranges changed within certain limits. The transmitter can be supplied with two, five or ten metre sensor head cable. The alarm output option enables two separate alarms that can be freely set by user.

| Options | |
|---|---|
| Alarm output | 2 relays 8A/230V SPCO relays |
| Power supply | 24 VDC (VAC) (standard), 115/230 VAC |
| Serial interface | RS 232C (standard), RS 485/422, current loop |
| Display cover | cover with or without local display & keypad |
| Cable length | 2, 5 or 10 metres |

# The operating principle of the DMP248

The DMP248 transmitter incorporates the DRYCAP® sensor which is optimized to be used in low humidities but has also an excellent tolerance against condensation. The DRYCAP® sensor uses an operating principle based on changes in capacitance as its thin polymer film absorbs water molecules together with a combined temperature measurement with a Pt 100 resistive temperature sensor. The capacitance of the thin polymer film has a direct response proportional to RH, but combined with the temperature signal the response of the DRYCAP® sensor is rather proportional to $P_W$ (water vapour pressure) or to the dewpoint.

While frostpoints (dewpoints below 0 °C) in principle can be determined by using traditional RH transmitters, it is very difficult considering the required accuracy at the dry end calibration. As relative humidity levels approach zero the accuracy rapidly decreases and the offset soon becomes the largest source of errors when monitoring frostpoints. Therefore, the focus is to minimize the offset (error at 0% RH) when monitoring the process gas.

For example to monitor a process with a frostpoint of -40 C and a temperature of +20 C translates to a relative humidity of 0.55%. An offset error of -0.2 %RH, which is well within specifications for a normal RH-transmitter, brings the measured RH down to 0.35%. This would bring the calculated frostpoint down to -44 C. Thus seemingly minor offset errors caused by drift or bad calibration translate into unacceptable frostpoint errors when the RH is low.

To solve the accuracy problem the DMP248 transmitter utilizes a new patented method that automatically adjusts the dry end measurement in frostpoints. The offset calibration algorithm incorporated into the DMP248 transmitter uses the fact that the capacitance of a thin film polymer sensor is proportional to RH as seen in formula 1.

$$RH_{out} = RH_0 + Gain * \frac{Pw}{Pws(T)} \qquad (2\text{-}1)$$

where:

$RH_0$=output in completely dry state
Pw=water vapor pressure
Pws(T)=temperature dependent water vapor saturation pressure

The function Pws(T) is well known from literature. Thus, it is possible to determine the offset ($RH_0$) if measurements are made at two or (preferably) more temperatures assuming a constant Pw during the process.

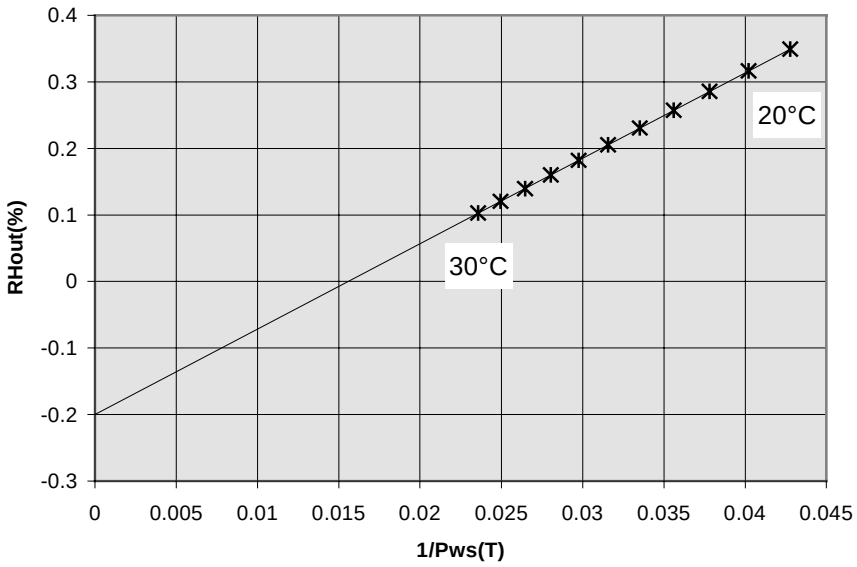



**FIGURE 2-1** Device output during hypothetical offset calibration cycle.

For example, for a transmitter with a -0.2%RH offset error is made 11 measurements at temperatures 20...30 °C. The frostpoint is assumed to stay constant at -40 °C and that the 'Gain' is nominal 100%.

As the temperature increases the RH drops. Since the response is linear, a straight line is fitted through the data points. The line intercepts the y-axis at $RH_0$ as shown in **FIGURE 2-1**. Now the $RH_0$ is known and it can be subtracted from the indicated value 0.35% RH to get the correct value of 0.55% RH.

**FIGURE 2-2** shows the DRYCAP® sensor as mounted on a DMP248 probehead. Through a combination of the polymer sensor and Pt 100 sensor, the DRYCAP® will accurately measure the water vapor pressure used in determining low dewpoints. During auto-calibration the Pt 100 element is used to first heat and then measure the temperature of the sensor while cooling back to ambient temperature. A complete cycle of auto-calibration takes 60...70 seconds. When the auto-calibration cycle is active, the transmitter locks the output values to those measured prior to auto-calibration.

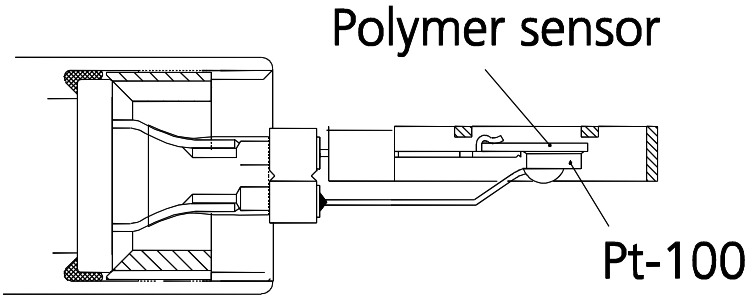



**FIGURE 2-2** The DRYCAP® sensor mounted on a DMP248 probe.

Note that the auto-calibration takes place only if the DMP248 is used in ambient humidities below 10 %RH (dewpoint below -12 °C at 20 °C) and at ambient temperature 0...+80 °C.

## Use in high pressure

If the process pressure differs from the normal ambient pressure, the value has to be entered in the transmitter memory to ensure the best possible measurement accuracy. The pressure setting is used for pressure compensation of the DMP248 transmitter. Note that although dewpoint is a pressure dependent parameter, this setting cannot be used for calculating dewpoints in different pressures. The probe should be installed to a place with pressure equal to that of the process in order to ensure the most reliable measurement. For converting pressure units, see Appendix 8.

**NOTE** The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the probe is not removed from the process as such (e.g. the process is shut down first), the process pressure can be max. 20 bars.

# CHAPTER 3 INSTALLATION

## Selecting the place of installation

Select a place which gives a true picture of the environment or process; also select a place that is as clean as possible. Air should circulate freely around the sensor.

It is recommended that the sensor head is installed directly in the process through the ball valve assembly. When the ball valve assembly is used, the chamber or the duct does not have to be emptied or shut down for installation or removal of the probe. Install the sensor head transversely against the direction of the process flow.

If the probe head has to be installed aside of the process gas flow or the process is very hot or particularly dirty, the probe can be installed in a “leak-through” position. In this installation, the probe is mounted behind the ball valve assembly and if necessary, a cooling coil and/or a filter can be mounted in between. The flow passes through the sensor head and leaks out through a vent hole in the fitting body enabling a reasonable response time. In hot and dirty processes, a sample system can also be used.

## Mounting the transmitter

In **FIGURE 3-1** and **FIGURE 3-2**, you can see the dimensions of the DMP248 transmitter:

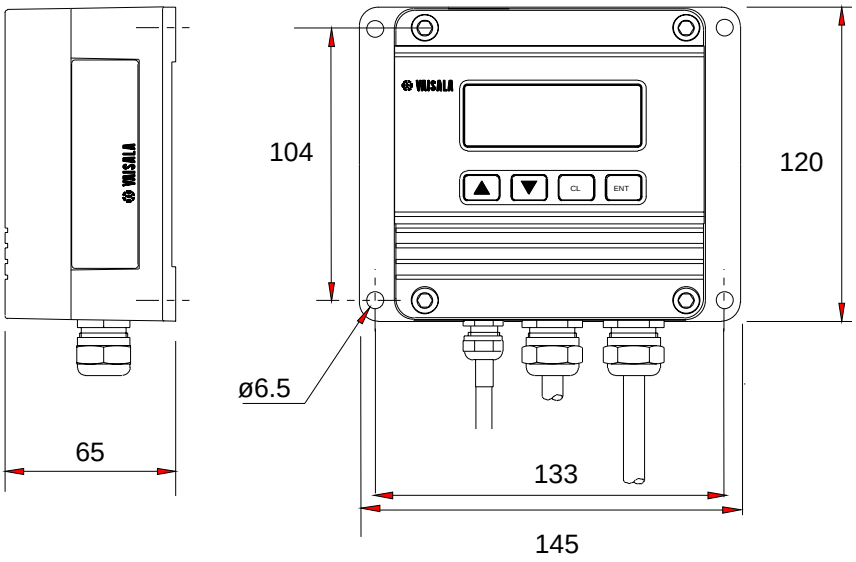



**FIGURE 3-1** Dimensions of the DMP248 electronics housing (in mm).

**NOTE**

1. Always mount the transmitter housing with the cable bushings pointing downwards to ensure IP65 (NEMA4) rating
2. Make sure that the connection cable has the right thickness (⌀7...10 mm) and that the cable bushing is carefully tightened.
3. Pay always special attention to closing the transmitter cover carefully and remember to tighten all four screws.

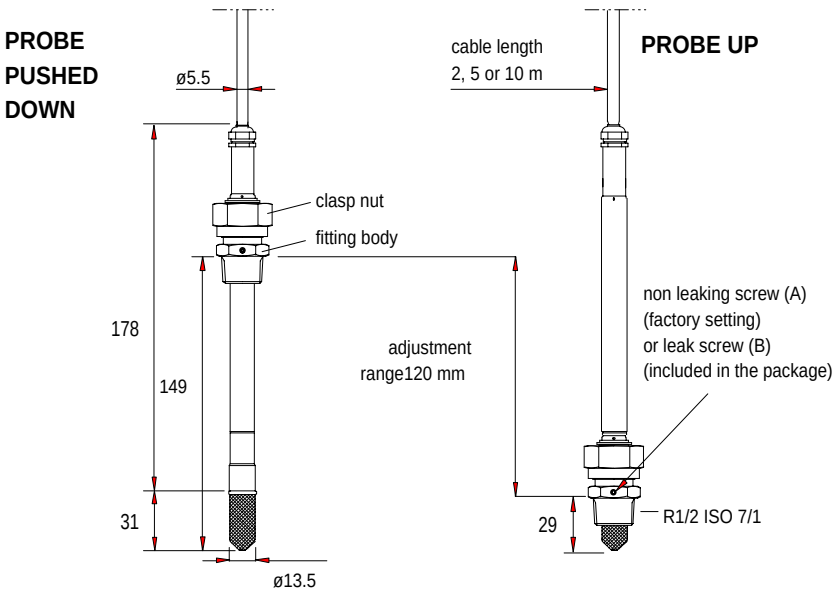



**FIGURE 3-2** Probe dimensions (in mm).

| **NOTE** | Take care not to damage the pipe of the probe. If the pipe is damaged, the probe head is less tight and it will not go through the clasp nut. |
|---|---|

## Mounting; overview

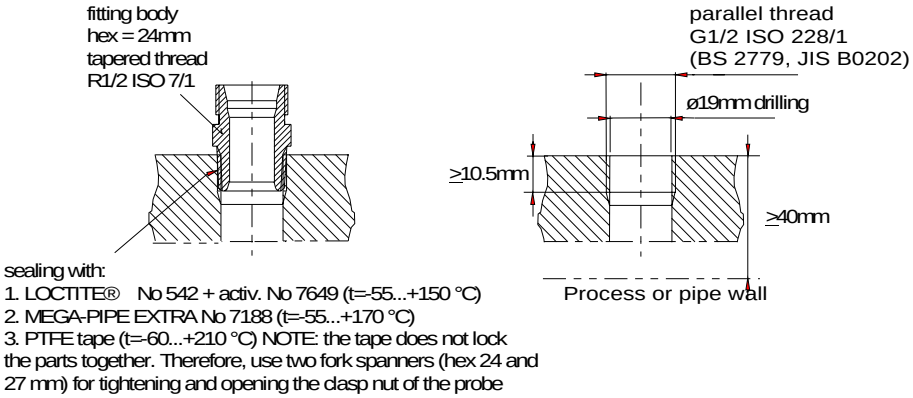

fitting body
hex = 24mm
tapered thread
R1/2 ISO 7/1
parallel thread
G1/2 ISO 228/1
(BS 2779, JIS B0202)
ø19mm drilling
≥10.5mm
≥40mm
Process or pipe wall
sealing with:
1. LOCTITE® No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock the parts together. Therefore, use two fork spanners (hex 24 and 27 mm) for tightening and opening the clasp nut of the probe

**FIGURE 3-3** Sealing and thread cutting for the fitting body.

The fitting body can be installed e.g. on standard pipe fittings (G 1/2 ISO 228/1) or on a thread in the process wall. If the wall thickness is less than 10.5 mm, it is recommended to use a welded sleeve (see **FIGURE 3-3**). Note that the minimum recommended distance of the fitting body and probe head is 40 mm (see **FIGURE 3-3**).

Adjust the probe to a suitable distance according to the type of installation, and tighten the clasp nut first manually. Then, mark the fitting body and the clasp nut and tighten the nut a further 50...60° with a fork spanner (see **FIGURE 3-4**).

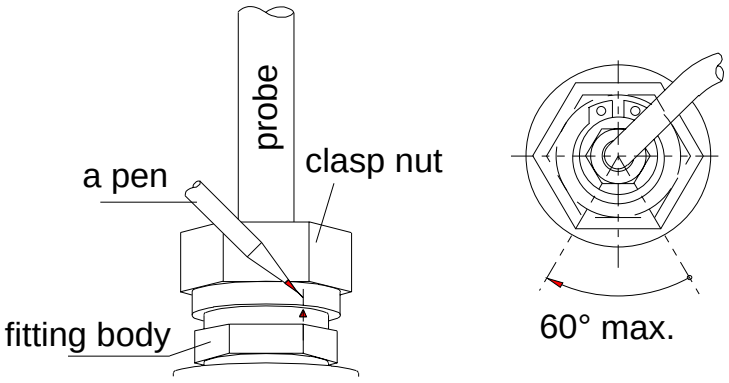



**FIGURE 3-4** Tightening the clasp nut.

| **NOTE** | Be careful not to tighten the clasp nut more than 60° as this may result in difficulties when trying to open it. |
|---|---|

The probe is delivered with non-leaking screw A mounted. For by-pass measurements, this screw is removed and replaced with leaking screw B (included) and an O-ring is placed on the groove of the sintered filter prior to installation. Make sure to tighten the screw carefully.

Screw B has a small (0.08 mm) laser-made hole in the middle; the gas or air to be measured passes through the sintered filter and by the sensor, and leaks out through the screw.

## Mounting the probe directly to the process

Select a point, which gives a true picture of the process. The transmitter can be installed directly in the process wall, especially if the pressure of the process is 1 bar (atmospheric processes).

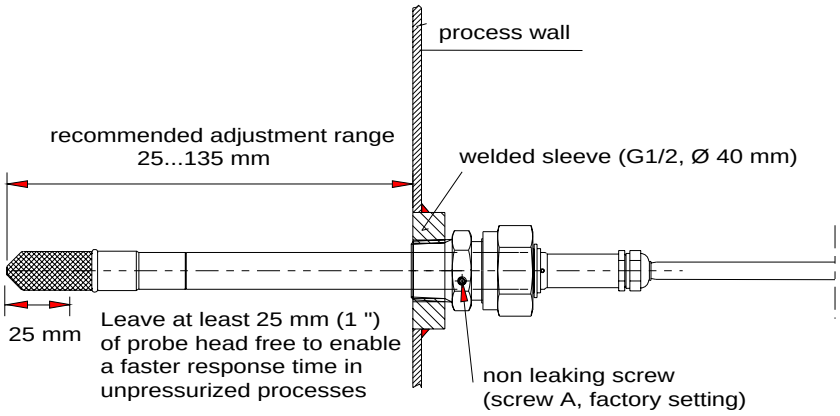



**FIGURE 3-5** Installing the probe in an atmospheric process.

If the probe is installed in process pipes where the water is likely to collect at the measurement point, take care to install the sensor head so that it will not be immersed in water.

When the probe is installed directly on the process wall or pipe, note that a closing valve may be needed on both sides of the installed probe so that the sensor head can be removed from the process for calibration and maintenance.

If the sensor head is installed in a pressurized chamber, always make sure that the pressure of the chamber is equalized with the ambient pressure prior to removing the probe.

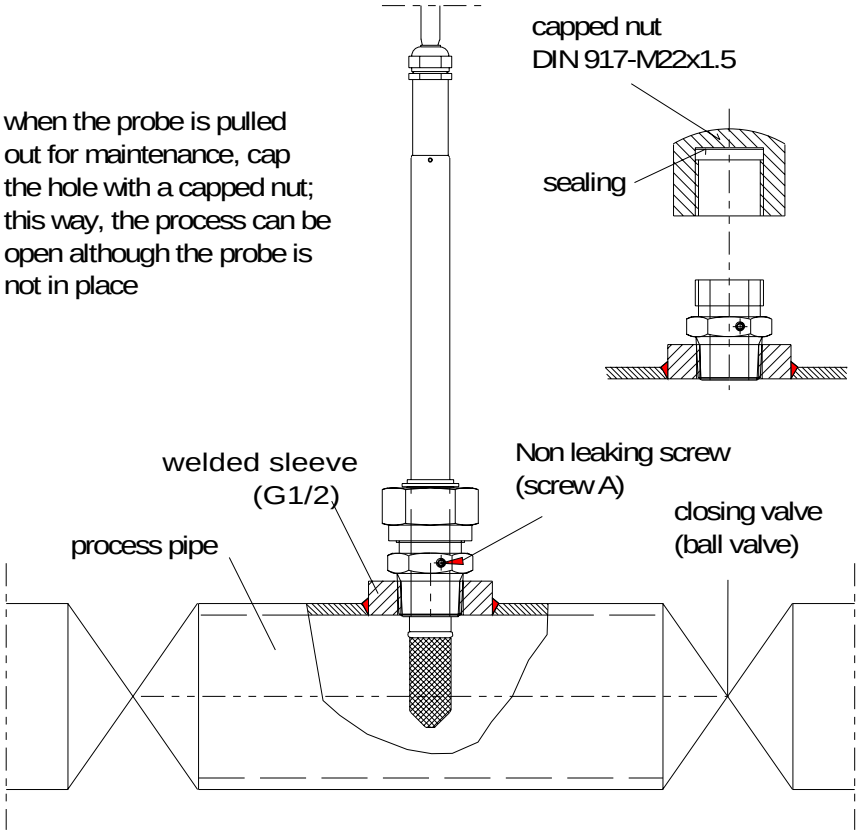

when the probe is pulled out for maintenance, cap the hole with a capped nut; this way, the process can be open although the probe is not in place
capped nut
DIN 917-M22x1.5
sealing
welded sleeve
(G1/2)
Non leaking screw
(screw A)
closing valve
(ball valve)
process pipe

**FIGURE 3-6** Installing the sensor head directly on the process pipe.

## Installing the probe through the ball valve assembly

The best way to install the sensor head is through the ball valve assembly. Use a 1/2" ball valve assembly with a ball hole of ∅14 mm or more. In this kind of installation, it is not necessary to empty or shut down the process for installing or removing the sensor head. If the sensor head is installed in a process pipe, please note that the nominal size of the pipe must be at least 1 inch. See **FIGURE 3-7** - **FIGURE 3-8** for detailed instructions.

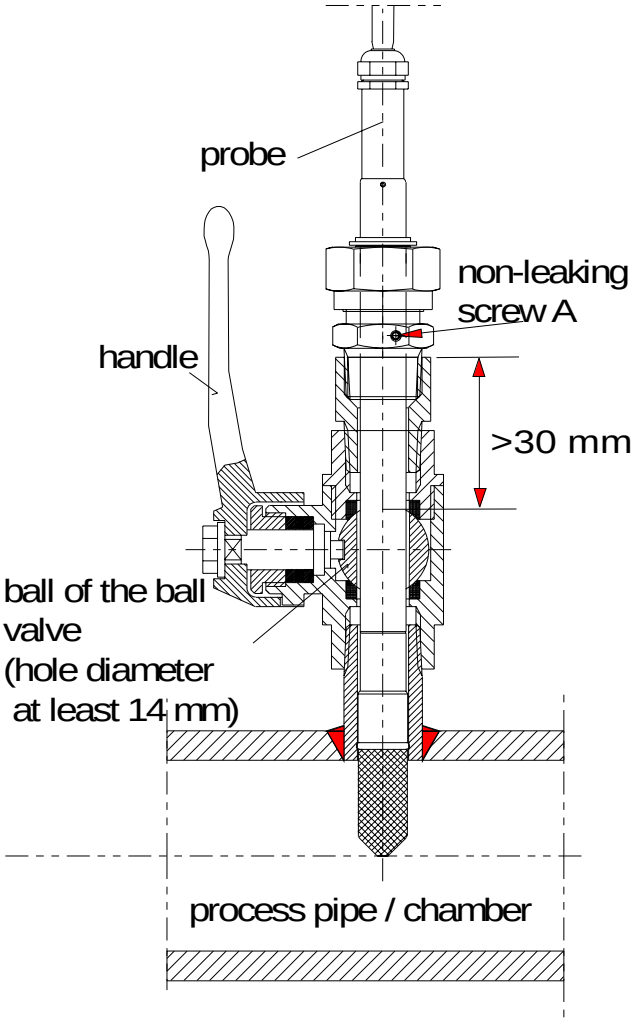



**FIGURE 3-7** Installing the sensor head through the DMP248BVS ball valve assembly.

| **NOTE** | The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars. |
|---|---|

See **FIGURE 3-8**- **FIGURE 3-11** for detailed description of installation through the ball valve assembly. **This installation is possible provided that the process pressure is less than 10 bars.** Note also that if the sensor head is installed in a process pipe, the nominal size of the pipe must be at least 1 inch.

- STEP 1: mount the probe with the ball valve assembly closed; tighten the clasp nut manually.

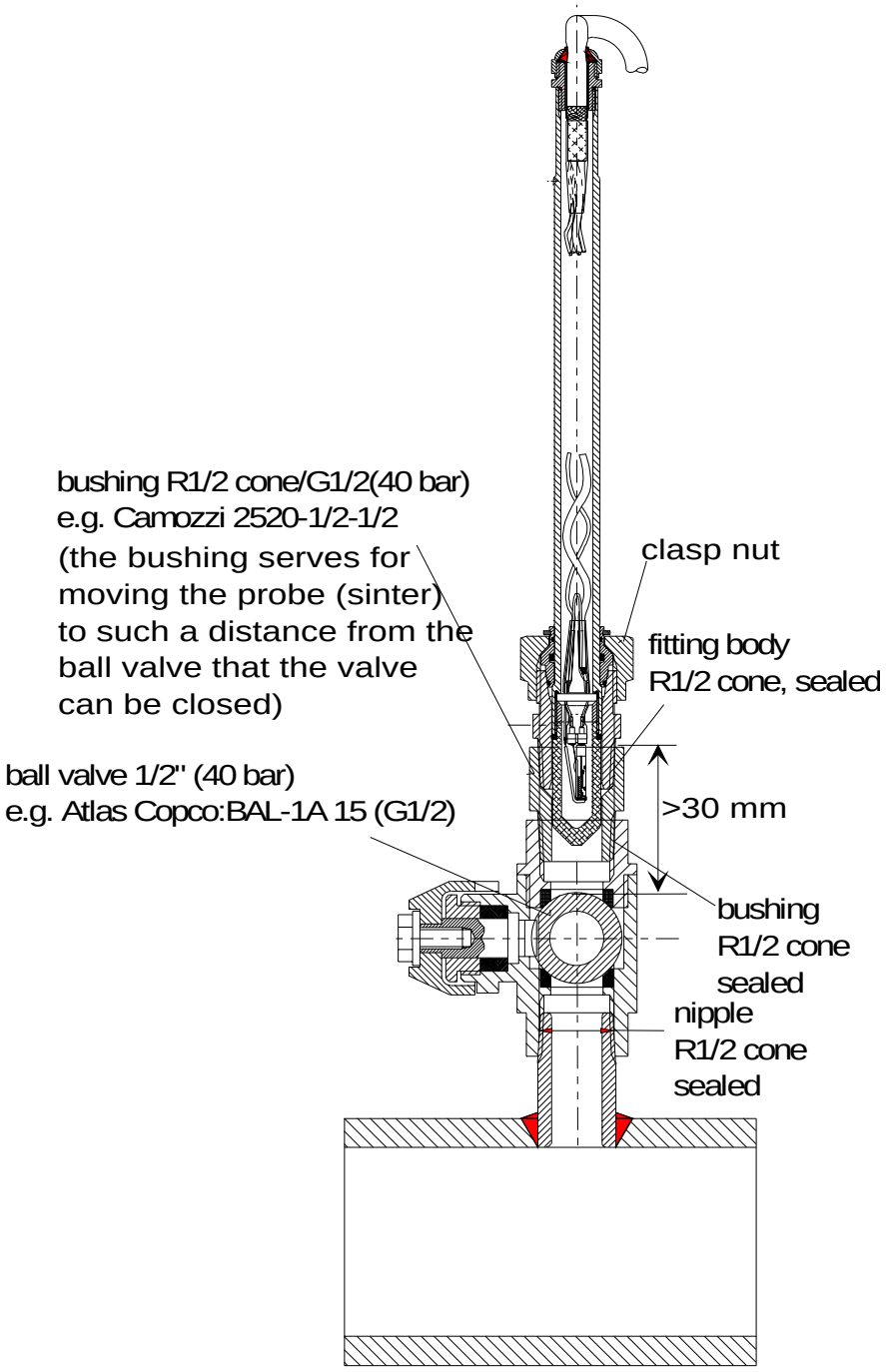



**FIGURE 3-8** Installing the probe through the ball valve assembly; step 1.

- STEP 2: open the ball valve assembly.

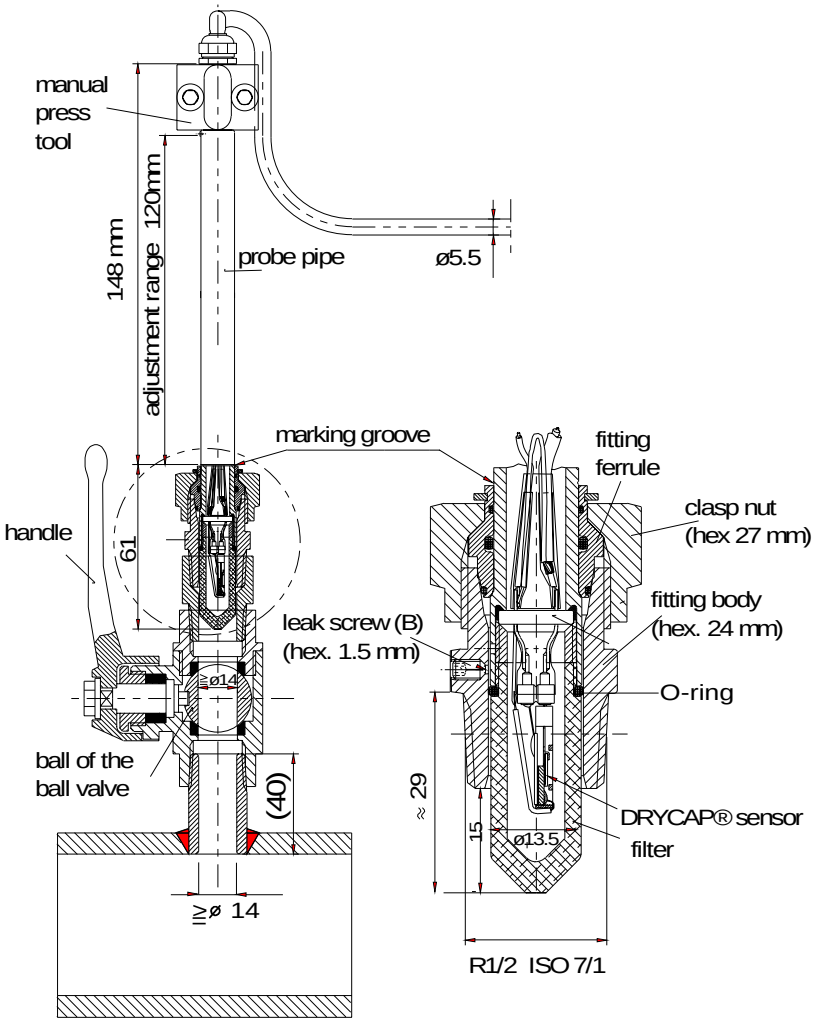



**FIGURE 3-9** Installing the probe through the ball valve assembly; step 2 (measures in mm).

STEP 3: push the probe head through the ball valve assembly into the process. If the pressure is high, use a manual press tool. Note that the sensor head must be pushed so deep that the filter is completely inside the process flow.

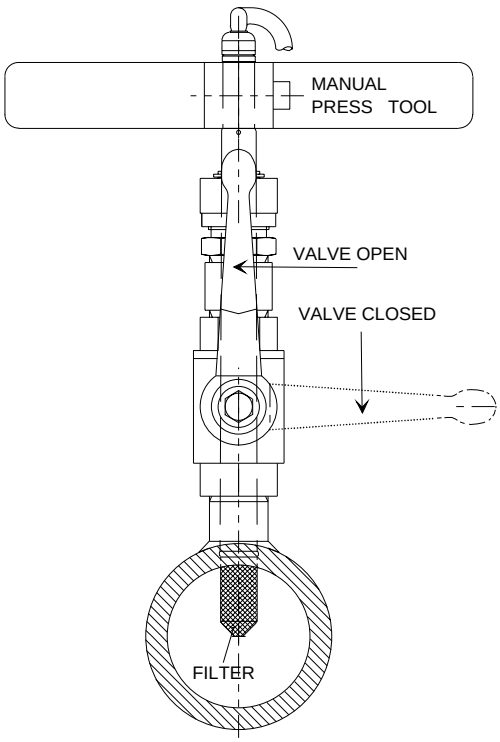



**FIGURE 3-10** Installing the probe through the ball valve assembly; step 3.

For by-pass measurements, the probe is mounted behind the ball valve assembly and non-leaking screw A on the fitting body is replaced with leaking screw B and O-ring is placed on the groove of the sintered filter. Screw B has a small (0.08 mm) laser-made hole in the middle; the gas or air to be measured passes through the sintered filter and by the sensor, and leaks out through the screw. The process pressure reduces in the hole of the screw B. This installation is recommended if the process flow rate is >20 m/s and there is over-pressure in the process.

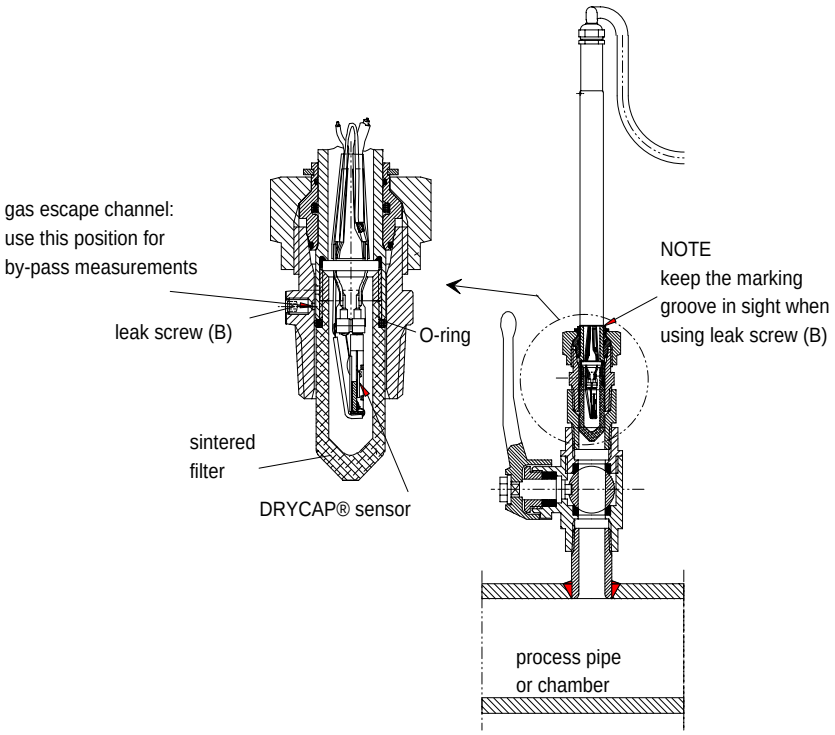



**FIGURE 3-11** Installing the sensor head for by-pass measurements.

When pushing the probe head through the ball valve assembly, be careful not to break the sintered filter. Open and close the ball valve assembly with the marking groove always in sight. In by-pass measurements, the clasp nut is tightened manually prior to pressing the probe through the valve. When the probe has been pressed through and the valve is open, the nut is tightened 50...60° with a fork spanner (hexagon 27 mm).

## Mounting the probe with a quick connect

The probe can also be installed with a quick-connect, which acts as a closing valve between the process and the probe. The installation can be easily done even in small ducts with standard parts, and the probe is easily removed when necessary. It is necessary for the probe to be installed in the leak-through position for a reasonable response time.

**FIGURE 3-12** illustrates an example of using a quick connect with the DMP248 probe. The chamber can be made of stainless steel AISI 316.

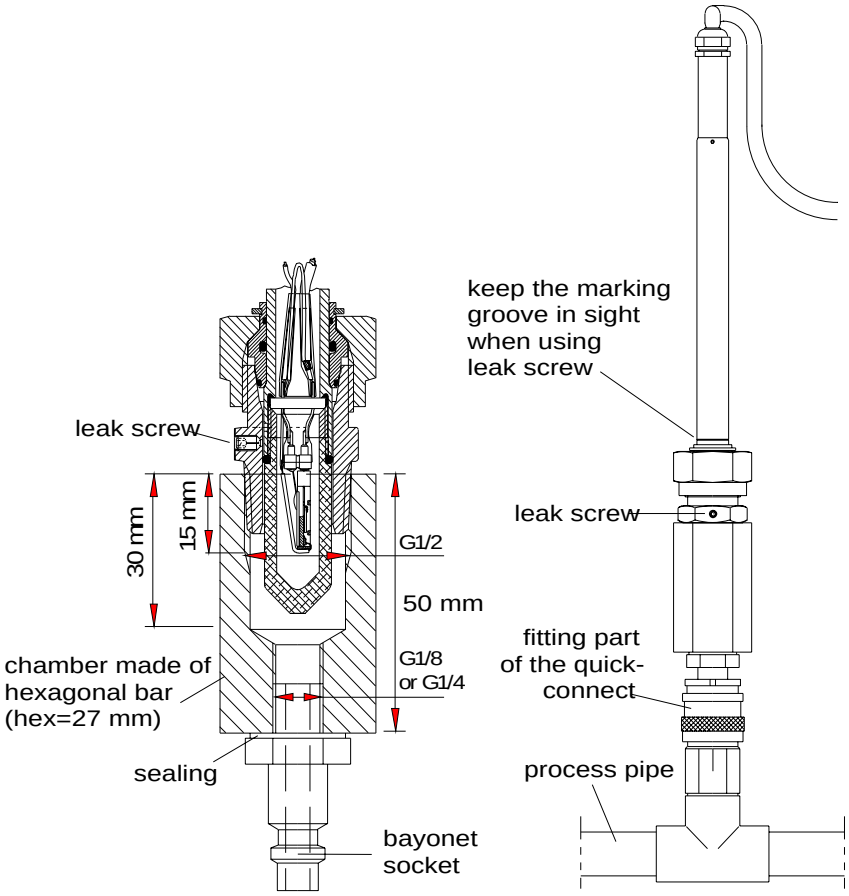



**FIGURE 3-12** Installing the probe with a quick-connect.

# Sample cell

It may be necessary to use the sample cell if the process (e.g. a pipe) is too small for the DMP248 sensor head. Furthermore, if the process is very hot (>80 °C) or particularly dirty, the probe is installed in a sample cell behind a cooling coil and/or filter. In this case, the ambient temperature must be at least 10 °C warmer than the process dewpoint in order to avoid condensation in the sample tubing.

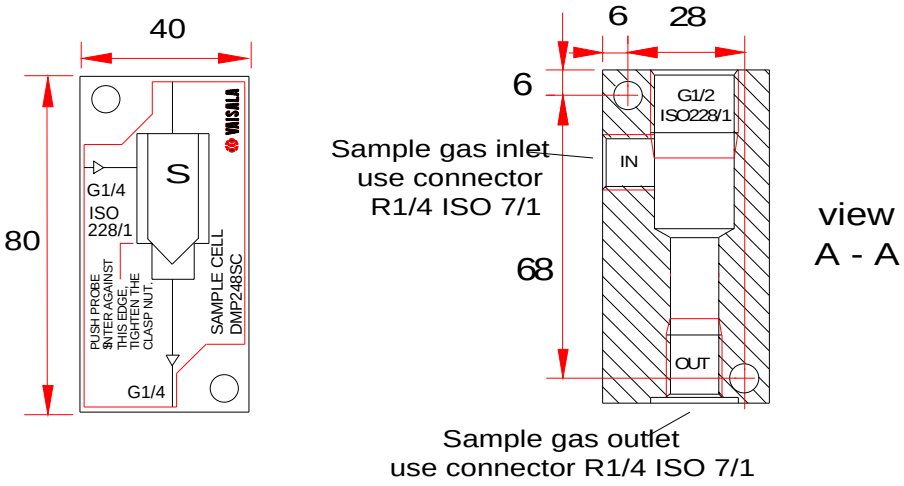



**FIGURE 3-13** Dimensions (in mm) of the DMP248SC sample cell.

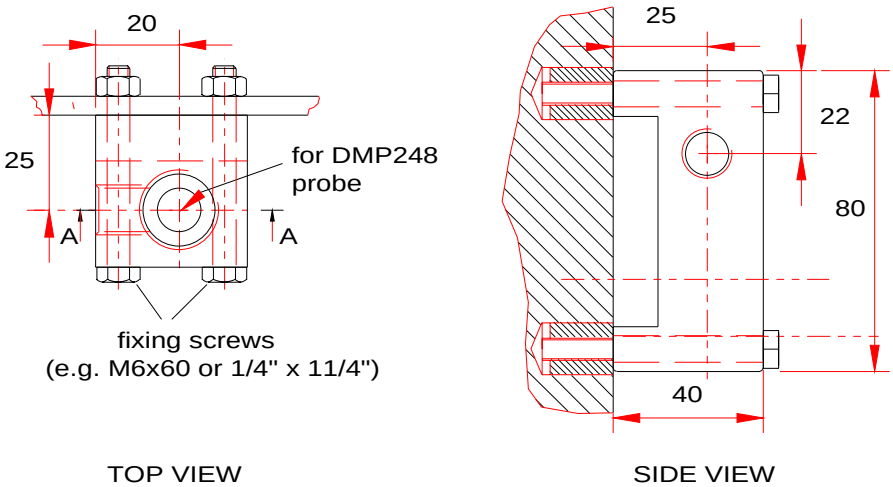



**FIGURE 3-14** Fastening to a metal plate (top view) and on a concrete frame (side view)

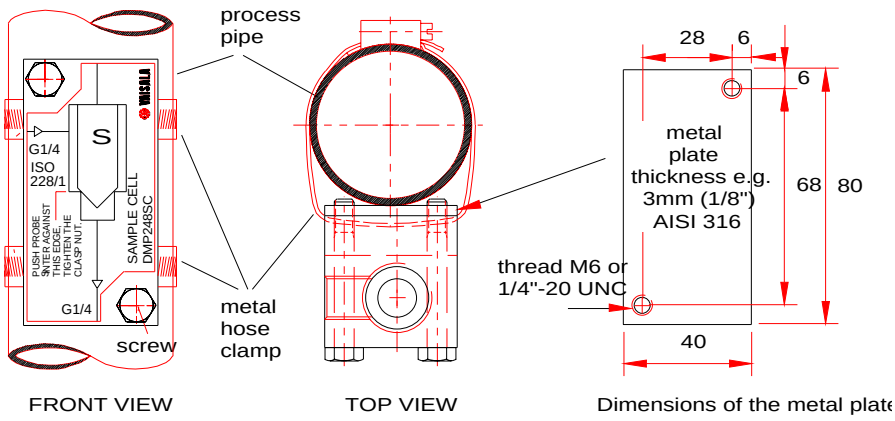



**FIGURE 3-15** Fastening to a process pipe with the help of a metal plate

An overpressure in the process is necessary to create a flow through the sample cell. Note that the pressure of the sample cell must not differ from that of the process because dewpoint temperature changes with pressure. In dirty processes, it may be necessary to use a filter between the cooling coil and the sample cell. One more simple way of using the sample cell with user provided accessories is shown in **FIGURE 3-16**. The flow through the sample cell is controlled with the needle valve and the pressure is kept equal to that of the process.

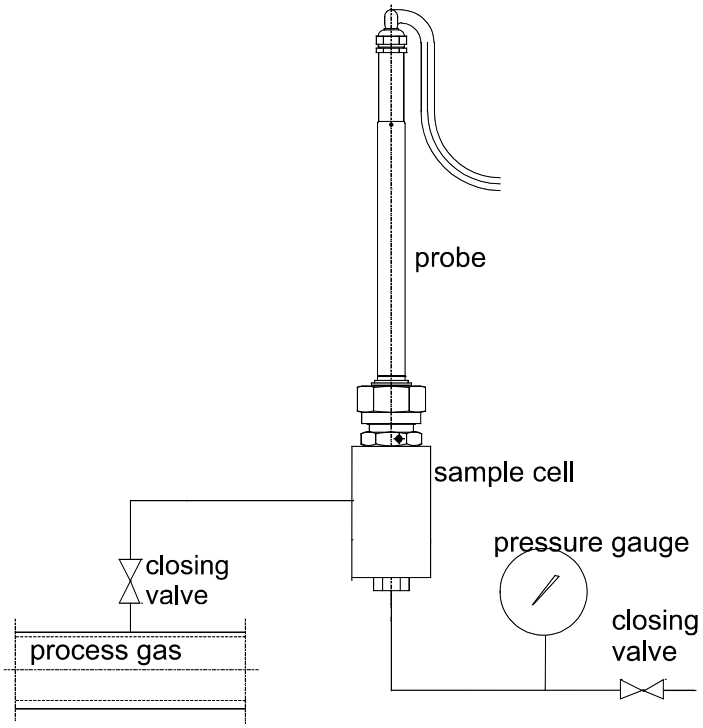


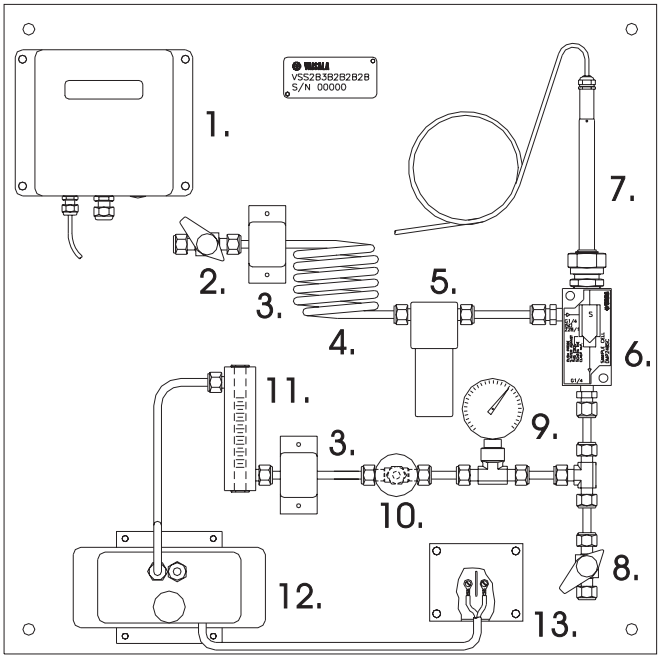

**FIGURE 3-16** Installing the probe in high temperatures (an example).

# Optional installation by means of the sampling system DSS10

When the operating environment is not suitable for direct installation of the measurement probe, an alternate solution could possibly be found with the complete sampling system DSS10.

The sample system allows for greater measurement accuracy and stability by controlling the temperature, pressure and filtration levels to optimize the performance of the sensor. The sampling system is designed with cooling coils to reduce temperatures above 80 °C and filters to remove particulate down to 0.01 micron of size. The system is also provided with valves, flow meters, pressure gauges and vacuum pumps to control flow rates and pressure levels.

Sample system is easy to install, operate and virtually maintenance free. It comes mounted on a steel plate to be fixed to the wall. Connect tubing from the process tap to the sample system to allow a sample of process gas to travel. Connect a power supply to the DMP248 transmitter and possibly to the vacuum pump. The system is now ready to operate. Turn the power on and adjust the values to achieve the desired gas flow rates and pressure levels. Note that these adjustments need to be done just once. As for maintenance, check the filter elements periodically. The interval depends on the application.




1. DMP248 transmitter
2. inlet valve
3. bracket
4. cooling coil
5. filter
6. sample cell
7. DMP248 probe
8. venting valve
9. pressure gauge
10. needle valve
11. flow meter
12. pump
13. power cord connection

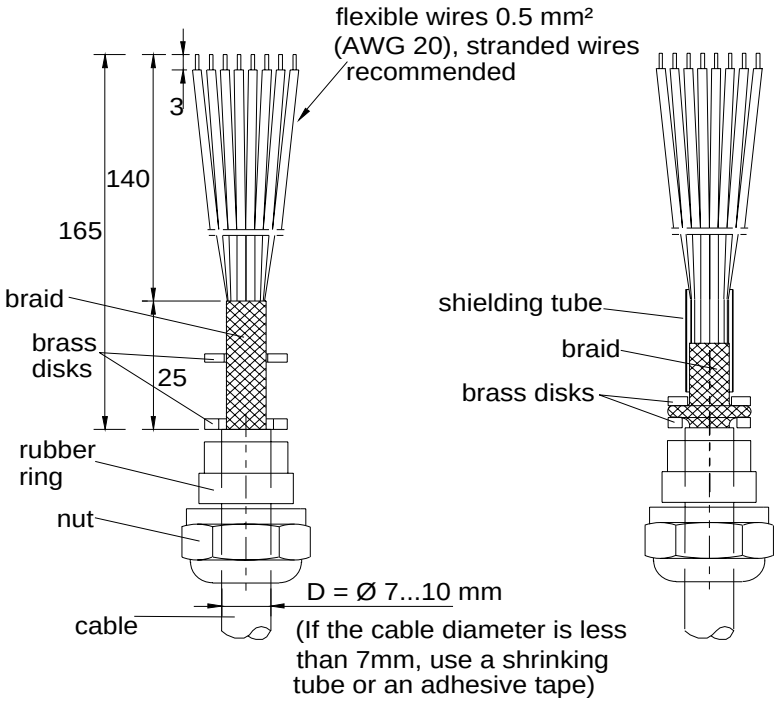
**FIGURE 3-17** Sample system DSS10Electrical connections

# Grounding

A single electrical cable with a screen and three to ten wires is recommended for power and analogue output/serial bus connections. The cable diameter should be 7...10 mm.

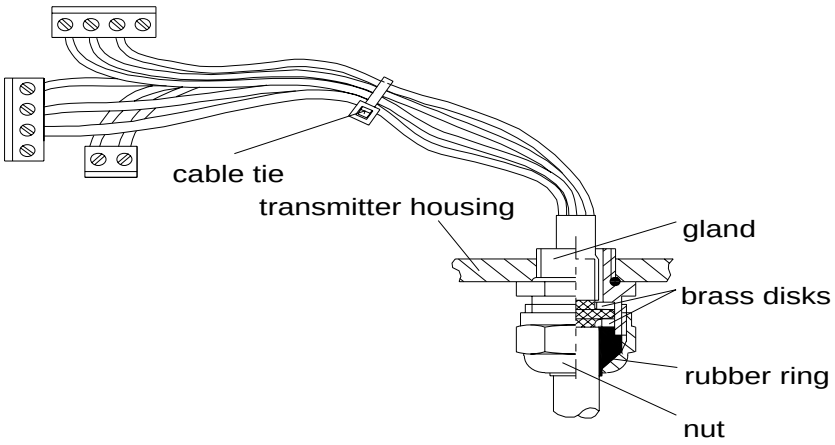
The screen of the electrical cable must be grounded properly to achieve best possible EMC performance. Recommended cable shield is done in the cable gland as shown.

- remove the brass disks, rubber ring and nut from the transmitter housing
- strip 165 mm of the cable insulation, but leave 25 mm of the braid visible
- slip the nut and rubber ring over the cable insulation
- slip the brass disk that has the bigger hole in it over the braid so that it rests against the cable insulation
- slip the other brass disk over the wires to the middle of the braid



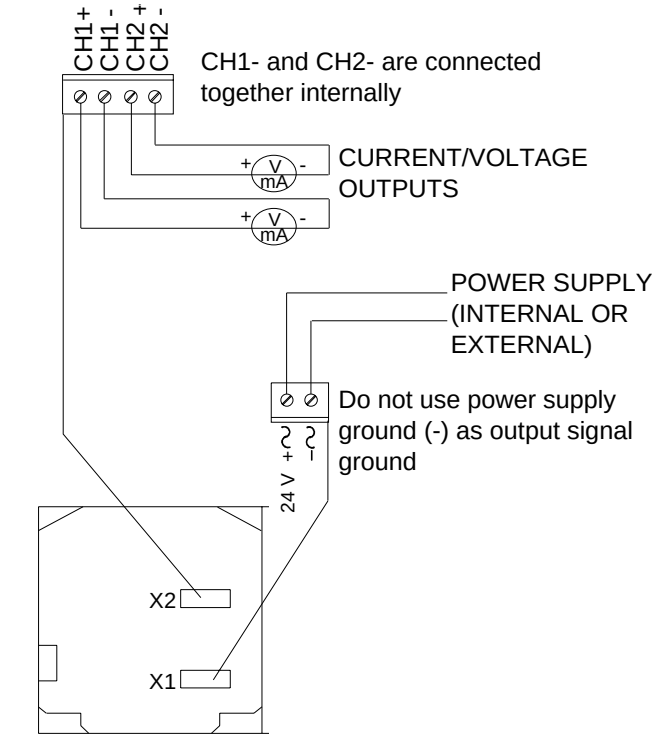

- push back the braid and press it between the two brass disks to achieve a full 360° grounding; the fold between the disks should have the same diameter as the brass disks
- secure the braid with a shielding tube
- insert the wires into the transmitter housing through the gland

- tighten the nut
- connect the wires into the screw terminals and fasten a cable tie around the wires




**NOTE** When the cable is grounded as explained, the metallic parts of the sensor head, the screen of its cable, the transmitter housing and the screen of the signal cable to external system are all connected to each other. After this, the whole system can be grounded from one point only. If the grounding is made via several points (sensor head, transmitter housing, signal cable), make sure that the different groundings are made to the same grounding potential. Otherwise, harmful grounding currents may be generated. If you do the grounding via the transmitter housing, use one serrated lock washer between a mounting screw and the housing; the lock washer breaks the paint on the housing.

# Connections




OPENED COVER OF THE DMP248

**FIGURE 3-18** Electrical connections

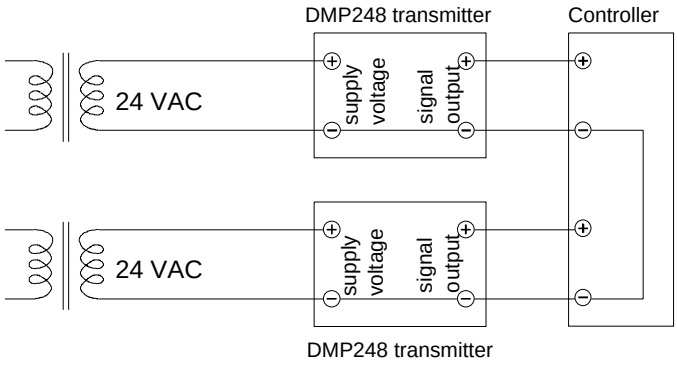
| | |
|---|---|
| Power supply | 24 VDC<br>24 VAC (see Chapter Connection to an AC supply) |
| Output signals | 0...20 mA<br>4...20 mA<br>0...1 V<br>0...5 V<br>0...10 V |

Power supply ground (-) is connected to the housing with parallel connection of 15 nF capacitor and 300 kΩ resistor.

# Connection to an AC supply

The DMP248 transmitter can also be connected to an AC supply without an external rectifier. However, when more than one transmitter is connected for example to one 24 VAC transformer, a common loop is formed and there is an increased risk of a short-circuit. To avoid this, always use separate floating supply for each transmitter (see **FIGURE 3-19**A). However, if several transmitters have to share one transformer, the phase (~) must always be connected to + connector in each transmitter (see **FIGURE 3-19** B).

A) NO COMMON LOOP FORMED - RECOMMENDED




B) COMMON LOOP FORMED - **NOT RECOMMENDED!**

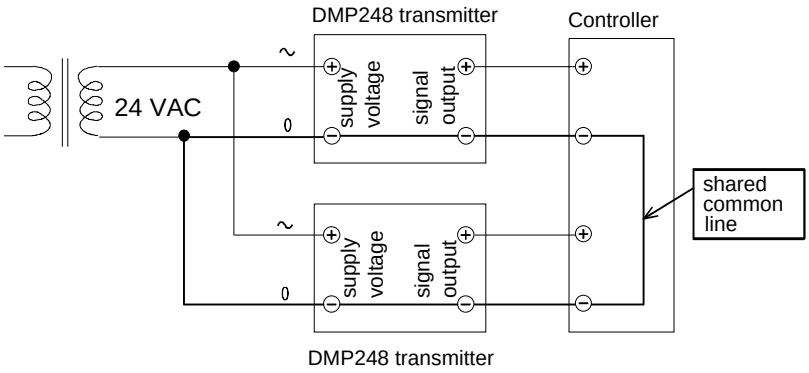



**FIGURE 3-19** Connecting the transmitter to an AC supply.

# CHAPTER 4 COMMISSIONING

When the DMP248 transmitter leaves the factory, its measurement ranges and output signals have already been selected. The user can subsequently change the measurement units between metric and non-metric and select and scale the output signals with software functions, see Chapter Selecting and scaling the analogue output quantities and Appendix 1.

## Security lock jumper

Before the settings can be changed, the user must first remove the security lock jumper in connector X15 (see **FIGURE 4-1**). The security lock jumper makes it impossible to change the transmitter settings by mistake. The jumper should be removed only for changing the settings and for calibration; the auto-calibration is active only with the jumper connected. When the security lock jumper is connected, some commands cannot be used (see Chapter Commands and security lock jumpers).

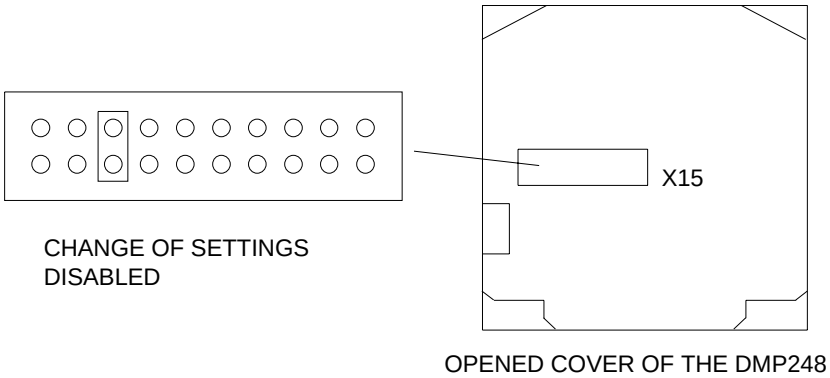



**FIGURE 4-1** Location of the security lock jumper.

# Selecting the analogue outputs

The DMP248 transmitter can be ordered ready with the current or voltage outputs required. If the outputs need to be changed, move the jumpers in connector X15 into positions as shown in **FIGURE 4-2**.

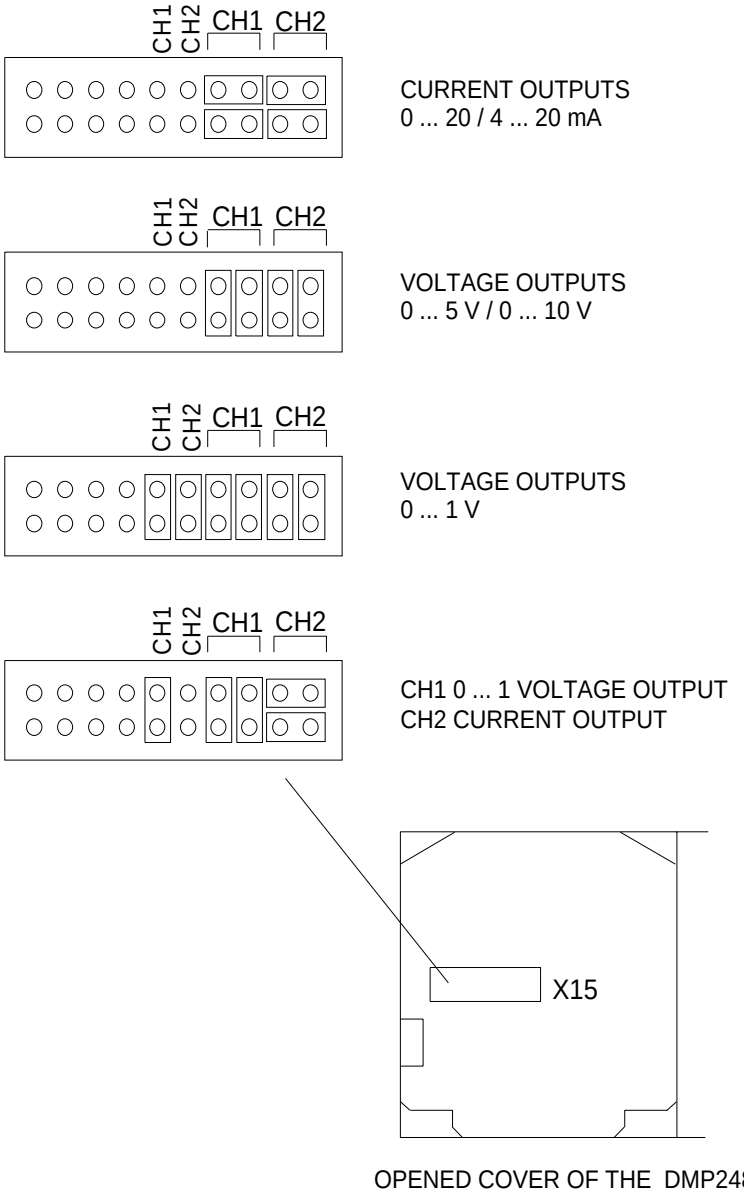
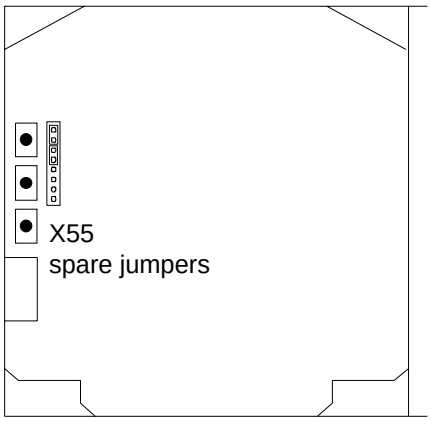



**FIGURE 4-2** Selecting the analogue outputs with jumpers.

The software also has to be informed which outputs are in use. This is done either through the serial interface or the menus on local display when in use. The serial command is AMODE and the display/keypad command "Mode ⇨ Analog outputs ⇨ Mode" (see Chapter 5 commands). If the outputs need to be scaled, see serial

command ASCL and the display command "Mode ⇨ Analog outputs ⇨ Scale".

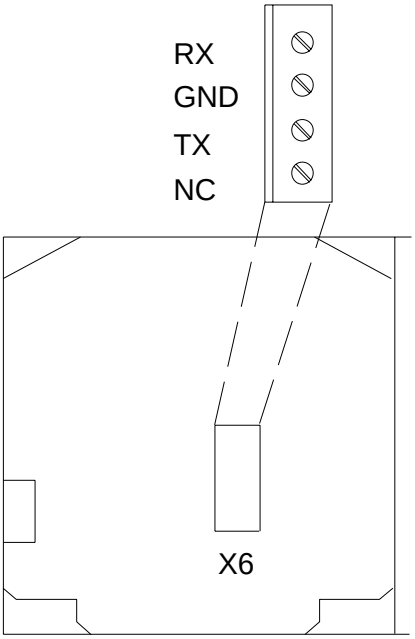
All jumpers are used only with the 0...1 V outputs. When other outputs are in use, the spare jumpers are kept in connector X55.




OPENED COVER OF THE DMP248

**FIGURE 4-3** Spare jumpers

# Connecting the RS 232C serial bus




OPENED COVER OF THE DMP248

**FIGURE 4-4** Serial bus connections.

To connect a PC to the DMP248 transmitters via the RS 232C serial bus, one of the following cables is required. The type of cable depends on the terminal and the connector type.

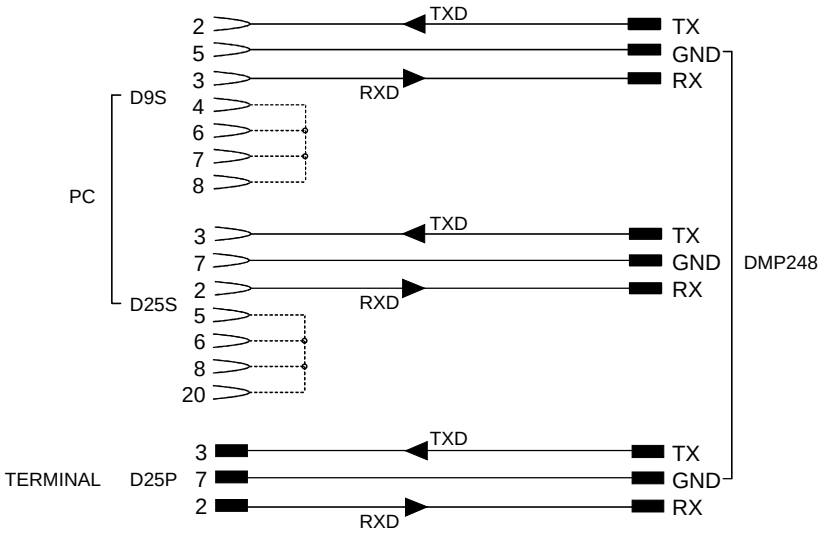



**FIGURE 4-5** Connection of cables.

When the serial bus has been connected between the PC and the transmitter, the PC is switched on. When using a PC, a terminal emulation programme (e.g. Procomm Plus, Datastorm or Windows terminal) is started.

The factory settings for data transfer are:

- 4800 baud
- even parity
- 7 data bits
- 1 stop bit
- full duplex

**NOTE** When the serial bus settings are changed, the transmitter has to be reset before the new settings become effective.

The processor does not allow the following combinations:

- no parity, 7 data bits, 1 stop bit: if this combination is given the DMP248 programme will change the number of stop bits to 2.
- even or odd parity, 8 data bits, 2 stop bits: if this combination is given the programme changes the number of stop bits to 1.

Refer to the manuals of the PC and the terminal emulation programme when giving serial settings.

The RS 232C screw terminal cannot be used if an RS 485/422 serial module or a current loop module is used. See Appendices 3 and 4 on how to install and operate these modules.

In calibrating or changing the settings of the transmitter, it can be more convenient to use the connector X17, if connector X6 is already in use. This connector, however, transfers only RS 232C signals. If a RS 485/422 serial port module or a current loop module has been installed, it has to be removed before communicating through the X17 connector.

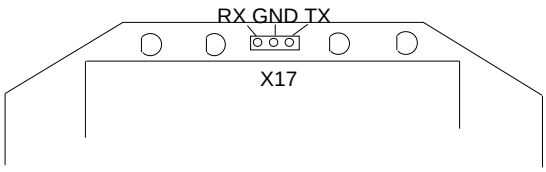



**FIGURE 4-6** Location and connections of connector X17.

| **NOTE** | Some PC computers can generate interferences to the measured humidity and temperature values if the transmitter and the PC are connected to different mains outlets. To minimize the possibility of these interferences, always use the same main outlet (same phase of the main electricity) for the PC and the power supply of DMP248. It is always preferable to use the connector X6 instead of the connector X17 because it is more immune to interferences. |
|---|---|

## Reverting to factory settings of the serial port

If the serial port settings are not known, no commands can be given via the serial interface. The settings can be reverted to the factory settings by inserting a jumper in connector X16. The jumper must be inserted when the power is on!

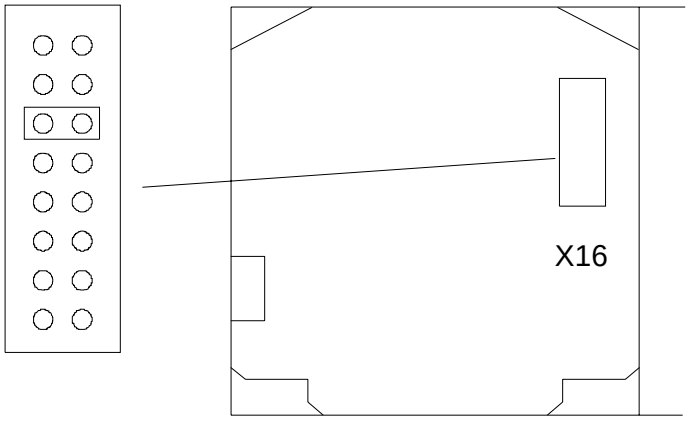



**FIGURE 4-7** Forcing the serial port settings back to factory settings.

When the jumper is inserted the serial line factory settings become valid, but only temporarily. **The transmitter must be given new settings; otherwise, the transmitter uses the old, unknown settings after power-up.** When the new settings have been given, the transmitter must be reset. The jumper must be removed before the

transmitter is reset; if the jumper is in place when power is turned on, the transmitter does not work.

After jumper insertion the transmitter is in STOP mode, ready to receive commands.

The same method is used when the transmitter is in POLL mode and the user has forgotten its address.

**CAUTION** Inserting a jumper in any other place in connector X16 voids the guarantee of the transmitter.

# CHAPTER 5 COMMANDS

The DMP248 transmitter uses a microprocessor; therefore, its configuration can be set according to the user's needs. This is done through commands, either utilizing the menus on the local display or giving commands through the serial interface (see Appendix 1). Most often, the commands are used to change the settings of the two analogue channels.

A limited range of commands can be given with the three press switches - up, down and enter - inside the transmitter housing. Four LEDs indicate the command given with the up and down switches. LED commands can be used to calibrate the transmitter (both humidity and temperature) or to calibrate the analogue outputs.

A full range of commands can be given through the display/keypad or through the RS 232C serial bus. The commands can be used e.g. to select and scale the outputs, to calibrate the humidity and temperature channels as well as the analogue outputs and to set the serial interface.

## Commands and security lock jumpers

In order to prevent any tampering with the transmitter settings, the transmitter cannot be calibrated, the analogue outputs set or the analogue output quantities selected or scaled unless the security lock jumper has been disconnected. The commands involved are:

- all LED commands (except DCAL)
- display/keypad commands:

| | | | | |
|---|---|---|---|---|
| Cali | ⇨ | RH T<br>Analog outputs | | |
| Mode | ⇨ | Analog outputs | ⇨ | Mode<br>Scale |

- serial commands:

  CRH, CT, FCRH, ACAL; AMODE, ASEL, ASCL

In the following, the description of these functions is preceded with a reminder of the security lock jumper:

**Disconnect the security lock jumper!**

# LED commands

| **NOTE** | If the transmitter has a display/keypad cover, the LED commands cannot be used. |
|---|---|

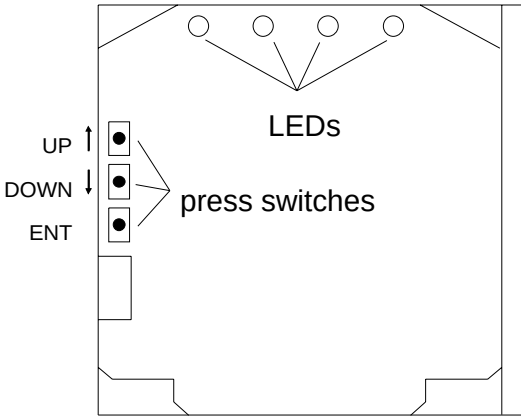



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**FIGURE 5-1** Location of press switches and LEDs

Use the up and down switches (marked with arrows on the printed board) to find the desired command code and acknowledge it with the ENT switch. The command codes are (● = lit, ○ = dark):

| | | |
|---|---|---|
| ○○○○ | (0) | return to normal state |
| ○○○● | (1) | relative humidity calibration |
| ○○●○ | (2) | temperature calibration |
| ○○●● | (3) | calibration of analogue outputs |
| ●○○● | (9) | forced auto-calibration (one auto-calibration; the security lock jumper must be connected) |

# Display/keypad commands

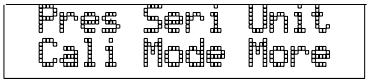
## Display mode

In the display mode, the transmitters output measurements on the display; different quantities can be scrolled with the arrow keys. The first line is scrolled with button σ and the second line with button τ; all selections are stored with ENTER. The selected quantities appear on the display also after power failure. After the reset, the transmitters are always in the display mode.

The display also shows error messages and alarms if they occur.

## Command mode

Press the CL key to enter the command mode. The first display is the main menu:




The commands can be scrolled with the arrow keys. The currently active command flashes; a command is selected with the ENT key. When a menu is displayed, either the first command or the currently valid setting flashes. The CL key takes the transmitter back to the display mode.

## Entering numbers

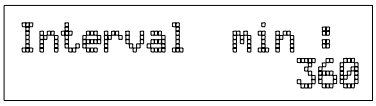
When the transmitter needs numbers to be entered into the programme (e.g. when scaling or setting the analogue outputs, in calibration or when giving the transmitter an address), the field is either empty or the currently valid figure is displayed. Any previously given value is deleted with the CL key.

When the field is empty, a cursor blinks at the right side of the display. Pressing the arrow keys brings either a blank (), a comma (**,**), a dash (**-**), a full stop (**.**) or a number from 0 to 9 on the display. The right character is selected with ENT; after that, the number or numbers move left one step. Entering numbers is ended with selecting a blank () and pressing ENT. The last character entered can be deleted with CL. If CL or ENT key is pressed when the field is empty, the program returns to the previous display.

With some commands (e.g. calibration) the figures are changed using the arrow keys. When an arrow key is pressed continuously for a while, the numbers start changing at an increasing rate.

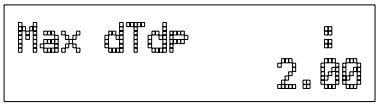
## Auto-calibration

- Select More in the main menu and then again More in the second More menu. Select Dry cal and then Settings.




- The interval parameter defines the frequency of auto-calibration cycles. When the transmitter is turned on, the first auto-calibration takes place after an hour unless the frequency has been set to less than an hour. After the first auto-calibration, the set frequency is activated and the auto-calibration takes place e.g. every six hours. If the setting is correct, press ENT.

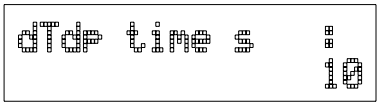
- If the setting needs to be changed, press CL and change the setting with arrow keys; acknowledge the setting with ENT. If the setting is changed, it becomes valid only after the next auto-calibration has been completed. If you wish to activate it immediately reset the transmitter or turn it off.




- This parameter defines the maximum allowed change of the dewpoint value during the pre-defined dTdp time. If the change in dewpoint value exceeds the limit, the calibration is not started. The auto-calibration is done only after process is stabilized. The transmitter retries untill the calibration is succesfully complited. Note that normally, this parameter does not have to be changed.

- If the setting is correct, press ENT.

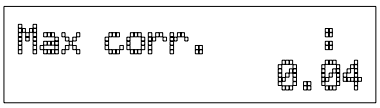
- If the setting needs to be changed, press CL and change the value with arrow keys; acknowledge the setting with ENT.



- This parameter defines the measuring time of the change in dewpoint prior to the auto-calibration (see the parameter Max dTdp).

- If the setting is correct, press ENT.

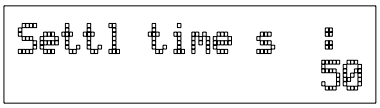
- If the setting needs to be changed, press CL and change the value with arrow keys. Acknowledge the setting with ENT.




- This parameter defines the maximum correction (%RH) the transmitter does during each auto-calibration cycle. If the correction exeeds the limit, the calibration is ignored. Note that normally, this parameter does not have to be changed.

- If the setting is correct, press ENT.

- If the setting needs to be changed, press CL and change the value with arrow keys; acknowledge the setting with ENT.




- This parameter defines the time the output values prior to the auto-calibration are frozen after the calibration. The time is for sensor temperature stabilization.

- If the setting is correct, press ENT.

- If the setting needs to be changed, press CL and change the value with arrow keys; acknowledge the setting with ENT.

**NOTE** Auto-calibration takes place only when the security lock jumper is connected. During auto-calibration, the reading on the display is frozen.

**NOTE** If the process pressure differs from the normal ambient pressure, the value has to be entered in the transmitter memory to ensure the best possible measurement accuracy. The pressure setting is used for pressure compensation of the DMP248 transmitter.

# Forced auto-calibration

- Select More in the main menu and then again More in the second More menu. Select Dry cal and then Calibration

- Select More in the main menu and then again More in the second More menu. Select Dry cal and then Calibration. The following is displayed:

  Calibration...

  press any key to abort

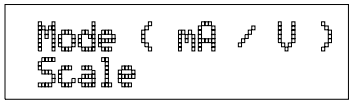
- If you press any key, the calibration is interrupted. If no key is pressed, the calibration takes place immediately. The text above is displayed during the calibration. If the process is unstable (see Chapter Auto-calibration) or relative humidity is over 10%, the calibration is not performed. The text above is only shortly displayed and the display returns to the measuring mode. The calibration is not performed again even if the maximum correction is exceeded.

# Analogue output commands

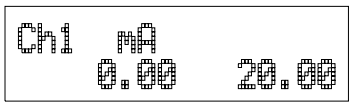
## Selecting the output (mA/V)

**Disconnect the security lock jumper!**

- Select Mode in the main menu and Analog outputs in the Mode menu:




- Select Mode ( mA / V ). The current settings for channel 1 are displayed:




- If the settings are correct, press ENT.

- If the settings need to be changed, press CL:

– the quantity (mA/V) starts flashing; it can be changed with the arrow keys and acknowledged with the ENT key

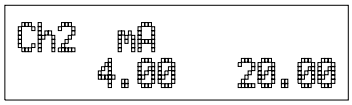
– the lower limit starts flashing

– acknowledge the lower limit with ENT or start changing it by pressing CL; a new lower limit is given one character at a time with the arrow keys

– the upper limit starts flashing

– acknowledge the upper limit with ENT or start changing it by pressing CL; a new upper limit is given one character at a time with the arrow keys

When channel 1 has been set, the programme goes on to channel 2; the procedure is the same as with channel 1.

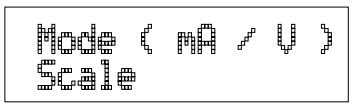



**NOTE** Also the analogue output jumpers must be set to correct places (see **FIGURE 4-2**)

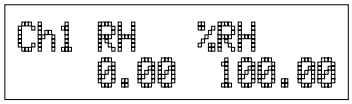
## Selecting and scaling the analogue output quantities

**Disconnect the security lock jumper!**

- Select Mode in the main menu and Analog outputs in the Mode menu:

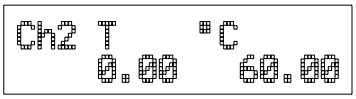



- Select Scale. The quantity and scaling for channel 1 are displayed:




- If the settings are correct, press ENT.

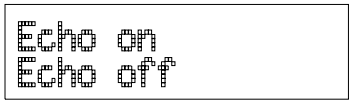
- If the settings need to be changed, press CL:
  - the quantity starts flashing; it can be changed with the arrow keys and acknowledged with the ENT key
  - the lower limit starts flashing
  - acknowledge the lower limit with ENT or start changing it by pressing CL; a new lower limit is given with the arrow keys
  - the upper limit starts flashing
  - acknowledge the upper limit with ENT or start changing it by pressing CL; a new upper limit is given with the arrow keys
  - When channel 1 has been set, the programme goes on to channel 2; the procedure is the same as with channel 1.




# Output via serial bus

## Turning the serial interface echo ON/OFF

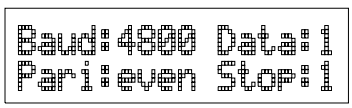
Select More in the main menu, select More in the More menu, then again More and then Echo.



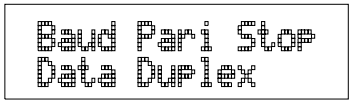

- Use the arrow keys to select the right alternative and press ENT.

## Serial bus settings

- Select Seri in the main menu; the currently valid serial interface settings are displayed:

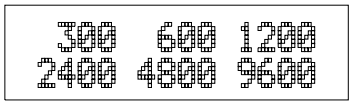



- If the settings are correct, press ENT; the programme returns to the display mode.
- If the settings need to be changed, press CL:

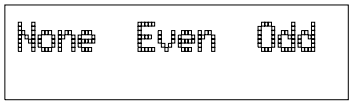



- Select the parameter to be changed with the arrow keys and ENT key.

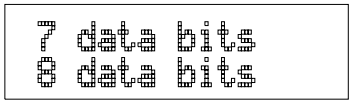
Selecting baud rate:



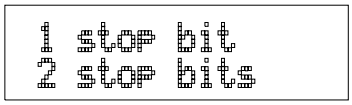

Selecting parity:



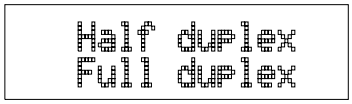

Selecting data bits:




Selecting stop bits:




Full duplex/half duplex:




The processor does not allow the following combinations:

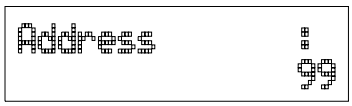
- no parity, 7 data bits, 1 stop bit: if this combination is given the DMP248 programme will change the number of stop bits to 2
- even or odd parity, 8 data bits, 2 stop bits: if this combination is given the programme changes the number of stop bits to 1

| **NOTE** | The serial bus settings become effective only after reset. |
|---|---|

### Setting the transmitter address

Address is used when more than one transmitter is connected to one serial bus; it makes it possible to communicate with one transmitter at a time.

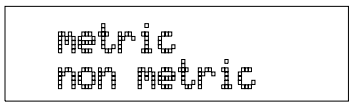
- Select More in the main menu and Addr in the More menu; the following is displayed:




- Pressing ENT returns the programme to the main menu.
- Pressing CL deletes the old address; enter the new address with the arrow keys.

### Selecting the output units

- Select Unit in the main menu:




- Use the arrow keys to select the right alternative and press ENT.

| | metric | non-metric |
|---|---|---|
| RH | %RH | %RH |
| T | °C | °F |
| Td | °C | °F |
| $ppm_v$ | ppm | ppm |

## Output modes

The output modes only affect output through the serial interface: the transmitter accepts all display and LED commands irrespective of which serial output mode it is in. The DMP248 transmitter has three serial output modes: RUN, STOP and POLL.

In the RUN state the transmitter outputs measurements automatically through the serial interface to a PC or a peripheral. The only command

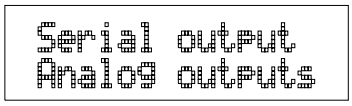
that can be given through the serial interface is S (stop) which ends the RUN state.

In the STOP state serial commands are given to the transmitters. Measurements are then output only by entering command SEND.

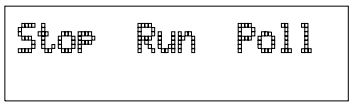
The POLL state is used when more than one transmitter is connected to the same serial bus; a single transmitter can be addressed and communicated with. When the connection to the one transmitter is opened in the POLL state, the transmitter goes into STOP state and can then receive commands normally. Closing the connection returns the transmitter to POLL state. In POLL state the transmitter outputs measurement only when requested (command SEND aa). If the user has forgotten the address of the transmitter and the transmitter does not have a display, the transmitter has to be reverted to the factory settings (see Chapter 0). If the transmitter has a display, the settings can be checked through it.

## Setting the serial interface operation mode

- Select Mode in the main menu; the following is displayed:



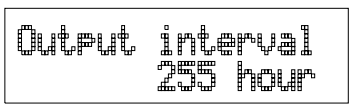

- Select Serial output:




- The currently valid setting flashes. Select the desired mode with the arrow keys and press ENT. After this the programme returns to the Mode Menu.

- When Run mode is selected, the currently valid output interval is displayed:

The output interval setting can be changed as follows:

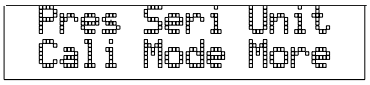


- press CL
- the number starts flashing
- if the interval needs to be changed, press CL again and enter the new interval; otherwise press ENT
- the unit (s, min, h) starts flashing
- the unit can be changed with the arrow keys and acknowledged with ENT
- after this the programme returns to Mode menu

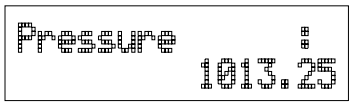
# Others

## Pressure compensation

The pressure is used for pressure compensation of the DRYCAP® sensor in order to ensure the best possible measurement accuracy. If the process pressure differs from normal ambient pressure, the value has to be entered in the transmitter memory. The pressure also has a considerable effect on the $ppm_v$ value. The pressure to be entered is the absolute pressure in hPa (for converting pressure units, see Appendix 8).




- Select Pres in the main menu and the following appears:

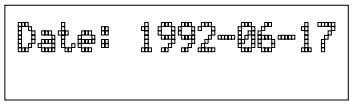



- Pressing ENT returns the programme to the main menu without changing the pressure reading.
- If the pressure needs to be changed, press CL; enter the new pressure with the arrow keys

| | |
|---|---|
| **NOTE** | The pressure compensation takes place only with the security lock jumper connected. If the security lock jumper is not connected, the pressure compensation is performed with the value 1013.25 hPa. |

## Setting the date

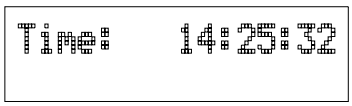
- Select More in the main menu; select Date in the More menu:




- If the date is correct, acknowledge it by pressing ENT; this takes the programme back to the More menu.
- If the date needs to be changed, press CL.
  - first the centuries (19) start flashing; use the arrow keys to change them and press ENT
  - the years (92) start flashing; use the arrow keys to change them and press ENT
  - the months (06) start flashing; use the arrow keys to change them and press ENT
  - the days (17) start flashing; use the arrow keys to change them and press ENT

## Setting the time

- Select More in the main menu; select Time in the More menu:




- If the time is correct, acknowledge it by pressing ENT; this takes the programme back to the More menu.
- If the time needs to be changed, press CL.
  - first the hours (14) start flashing; use the arrow keys to change them and press ENT
  - the minutes (25) start flashing; use the arrow keys to change them and press ENT

– the seconds (32) start flashing; use the arrow keys to change them and press ENT

| **NOTE** | The transmitter does not have a real-time clock with backup battery. This means that the date and time settings are not permanent. |
|---|---|

# Serial commands

More detailed descriptions of the serial commands can be found in Appendix 1. Here only the most commonly used command sequences are described. The instructions on how to connect the DMP248 transmitters to serial bus are given in Chapter Connecting the RS 232C serial bus.

Pressing ESC always interrupts any serial command being given. In the commands <cr> means carriage return.

## Auto-calibration

**DRYCAL<cr>**

```
>drycal
DCAL ON
Interval min : 360 ?
Max dTdp: 2.00 ?
dTdp time s : 10 ?
Max corr. : 0.040 ?
Settl time s : 50
>
```

The interval parameter defines the frequency of auto-calibration cycles. When the transmitter is turned on, the first auto-calibration takes place after on hour unless the frequency has been set to less than an hour. After the first auto-calibration, the set frequency is activated and the auto-calibration takes place e.g. every six hours. If the setting is changed, it becomes valid only after the next auto-calibration has been completed. If you wish to activate it immediately reset the transmitter or turn it off.

The Max dTdp parameter defines the maximum allowed change of the dewpoint value during the pre-defined dTdp time. If the change in dewpoint value exceeds the limit, the calibration is not started. The auto-calibration is done only after process is stabilized. The transmitter retries untill the calibration is succesfully complited. Note that normally, this parameter does not have to be changed.

The dTdp time defines the measuring time of the change in dewpoint prior to the auto-calibration (see the parameter Max dTdp).

The Max corr. parameter defines the maximum correction (%RH) the transmitter does during each auto-calibration cycle.

The Settl time defines the time the output values prior to the auto-calibration are frozen after the calibration. The time is for sensor temperature stabilization.

**NOTE** Normally, the Max dTdp and the Max corr. parameters need not be changed.

**NOTE** Auto-calibration takes place only when the security lock jumper is connected. With command <fst on>, the serial line printing indicates the stages of the auto-calibration (n = no auto-calibration, w,h,s = different phases in auto-calibration, S = settling time auto-calibration is on).

### DCAL<cr>

```
>dcal
Calibration...
any key to abort
>                 (appears when the auto-calibration
                   is completed in 60 - 70 seconds)
```

If you press any key, the calibration is interrupted. If no key is pressed, the calibration takes place immediately. If the process is unstable or relative humidity is over 10%, the prompt (>) appears immediately. In that case the calibration is not performed. The calibration is not performed again even if the maximum correction is exceeded. (see Chapter Display/keypad commands)

## Pressure compensation

**PRES pppp.pp <cr>**

where pppp.pp = absolute pressure (hPa).

value has to be entered in the transmitter memory in order to ensure the best possible measurement accuracy. The pressure setting is used for pressure compensation of the DMP248 transmitter. The pressure is given in hPa/mbar; for converting pressure units, see Appendix 8.

When the command is given, the transmitter first gives the current pressure; after this the new value can be entered or the current one acknowledged.

```
>PRES <cr>
Pressure :    1013.25 ? 1000.00 <cr>
```

When the current pressure is known, a new pressure can also be entered directly:

```
>PRES 1010 <cr>
Pressure : 1010
```

**NOTE** If the security lock jumper is not connected, the pressure compensation is made with the value 1013.25 hPa.

**NOTE** If the pressure setting is frequently adjusted, e.g. by using an external barometer as a pressure input source, the command XPRES is recommended (see Appendix 1).

# Analogue outputs

## Setting the analogue outputs

**Disconnect the security lock jumper!**

**AMODE a bb.bbb cc.ccc d ee.eee ff.fff <cr>**

| | | | |
|---|---|---|---|
| a | = channel 1: | U | = voltage output |
| | | I | = current output |
| bb.bbb | = lower limit of channel 1 | | |
| cc.ccc | = upper limit of channel 1 | | |
| d | = channel 2: | U | = voltage output |
| | | I | = current output |
| ee.eee | = lower limit of channel 2 | | |
| ff.fff | = upper limit of channel 2 | | |

The bb.bbb, cc.ccc, ee.eee and ff.fff parameters are entered in volts or milliamperes.

Example:

lower limit of channel 1 is 0 V and upper limit 1 V (U 0 1)

lower limit of channel 2 is 2 V and upper limit 10 V(U 2 10)

```
>AMODE U 0 1 U 2 10 <cr>
Ch1 :  0.000 ...   1.000 V
Ch2 :  2.000 ...  10.000 V
```

## Selecting and scaling the analogue output quantities

**Disconnect the security lock jumper!**

**ASEL xxx yyy <cr>**

xxx = channel 1's quantity

yyy = channel 2's quantity (RH, T, Td, ppm)

Example: dewpoint temperature selected on channel 1 and temperature on channel 2

```
>ASEL  Td  T <cr>
Ch1  ( Td  )  lo   -50.00 'C     ? -40<cr>
Ch1  ( Td  )  hi    10.00 'C     ?   0<cr>
Ch2  ( T   )  lo    10.00 'C     ?   0<cr>
Ch2  ( T   )  hi   100.00 'C     ?  60<cr>
>
```

### Scaling the analogue outputs

**Disconnect the security lock jumper!**

**ASCL <cr>**

Example: dewpoint is scaled in the range of -40...0 °C and temperature in the range of 0...+60 °C

```
>ASCL <cr>
Ch1  ( Td )  lo   -50.00 'C     ? -40<cr>
Ch1  ( Td )  hi    10.00 'C     ?   0<cr>
Ch2  ( T  )  lo    10.00 'C     ?   0<cr>
Ch2  ( T  )  hi   100.00 'C     ?  60<cr>
>
```

## Output via the serial bus

### Starting the measurement output

**R <cr>**

Starts output of measurements to the peripheral devices (RUN mode); the only command that can be used is S (stop).

The output format can be changed with command FORM (see Appendix 1).

## Stopping the measurement output

**S<cr>**

Ends the RUN mode; after this command all other commands can be used.

## Outputting the reading once

**SEND <cr> in STOP mode**

or

**SEND aa <cr> in POLL state**

aa = address of the transmitter when more than one transmitter is connected to a serial bus (0...99)

Output:

```
    Td= -9.3 'C PPM=   2733 T= 22.1 'C RH= 10.4 %RH
    Td= -9.3 'C PPM=   2730 T= 22.1 'C RH= 10.4 %RH
...
```

The output format can be changed with command FORM (see Appendix 1).

## Setting the output interval for the RUN mode

**INTV xxx yyy <cr>**

xxx = output interval (0...255)
0: no pause between outputs
yyy = unit (s, min or h)

Example: output interval is changed into 10 minutes

```
>INTV 10 min <cr>
Output intrv. :  10 min
```

## Serial bus settings

**SERI b p d s x <cr>**

b = bauds (300, 600, 1200, 2400, 4800, 9600)
p = parity (n = none, e = even, o = odd)
d = data bits (7 or 8)
s = stop bits (1 or 2)
x = duplex (H = half, F = full)

The settings can be changed one parameter at a time or all parameters at once:

```
>SERI O <cr>                    changing parity only
4800 O 7 1 HDX

>SERI 600 N 8 1 F <cr>          changing all parameters
600 N 8 1 FDX
```

The processor does not allow the following combinations:

- no parity, 7 data bits, 1 stop bit: if this combination is given the DMP248 programme will change the number of stop bits to 2
- even or odd parity, 8 data bits, 2 stop bits: if this combination is given the programme changes the number of stop bits to 1

**NOTE** The serial bus settings become effective only after reset.

When the half-duplex mode is set, it will automatically turn the echo off. Even then, the ECHO command can indicate that echo is on.

## Selecting the output units

**UNIT x <cr>**

x = m(etric units) (°C)
n(on-metric units) (°F)

## Setting the transmitter address

**ADDR aa <cr>**

aa = address (0...99)

Example: transmitter is given address 99

```
>ADDR <cr>
Address        : 2 ?  99 <cr>
```

### Resetting the transmitter

**RESET <cr>**

## Operating the transmitter via the serial bus

### Setting the serial interface

**SMODE xxxx<cr>**

xxxx = STOP, RUN or POLL

In STOP mode: measurements output only by command, all commands can be used
In RUN mode: outputting automatically, only command S can be used
In POLL mode: measurements output only with command SEND. When in POLL state, the output state is changed as follows:

**OPEN aa <cr>**
**SMODE xxxx<cr>**

aa = address of the transmitter
xxxx = STOP, RUN or POLL

The OPEN command sets the bus temporarily in STOP state so that the SMODE command can be given.
Example:

```
>SMODE STOP <cr>              setting STOP state
Serial mode     : STOP
```

### OPEN & CLOSE

**OPEN nn <cr>**

nn = address of the transmitter (0...99)

**CLOSE <cr>**

In STOP mode: command OPEN has no effect, CLOSE sets the transmitter in POLL mode
In POLL mode: command OPEN sets the transmitter temporarily in STOP mode, command CLOSE returns the instrument to POLL mode

Example: relative humidity calibration is performed at transmitter 2 which is in POLL state

| | |
|---|---|
| `>OPEN 2 <cr>` | opens the line to transmitter 2 |
| `>CRH <cr>` | calibration started |
| `...` | |
| `>CLOSE <cr>` | line closed |

# CHAPTER 6 CALIBRATION

The DMP248 transmitter has been fully calibrated at the factory so there should be no immediate need for recalibration. The transmitter should be calibrated only if there is reason to believe that the adjustments have changed. The adjustments of the temperature measurement channel and the analogue outputs are particularly stable and in normal circumstances, there is no need to recalibrate them. Humidity calibration should be performed at least once a year.

## Humidity calibration

The DMP248 transmitter is calibrated against two accurate RH references. The calibration can be performed by the end-user, or the instrument can be sent to Vaisala or a Vaisala representative. A two-point calibration can be performed with Vaisala's HMK15 or HMK13B Calibrator.

A Ø 13.5 adapter must be used when calibrating with the HMK13B Calibrator. The adapter (part no. 16611) can be ordered from Vaisala or Vaisala representatives.

Calibration can be performed by giving the commands using the press switches inside the housing, through the serial bus (serial commands) or through the menus on the local display (display/keypad commands).

When LED commands are used and when the two analogue channels do not output either relative humidity and/or temperature, relative humidity is calibrated on channel 1 and temperature is calibrated on channel 2. The calibration ranges are 0...100 %RH and -20...+80 °C. When the transmitter is calibrated at two points, the points must be either 50 %RH or 50 C apart from each other.

| **NOTE** | As relative humidity is a temperature dependent parameter, the probe and the salt bath calibrator have to stabilize to the same temperature for best accuracy. |
|---|---|

# Two-point calibration procedure

A two-point humidity calibration should be performed in stable conditions using saturated salt solutions as references.

## Using serial commands

- Leave the calibrator and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap on the transmitter.

**Disconnect the security lock jumper before turning the transmitter on!**

- Place the sensor head in the calibration hole of the LiCl bottle (dry end reference) in the humidity calibrator.
- Wait for 10 minutes.
- Give command CRH <cr>, enter the first point value and press <cr>.

```
>CRH <cr>
RH :  xx.x   Ref1 ?  yy.y <cr>
Press any key when ready...
```

- If you want to see how the sensor stabilizes to the humidity in the calibrator, enter c <cr> instead of the first reference:

```
RH : 11.9  Ref1  ? c <cr>
RH : 11.5  Ref1  ? c <cr>
RH : 11.5  Ref1  ? 11.3 <cr>
Press any key when ready...
```

- Place the sensor head in the calibration hole of the NaCl bottle (wet end reference) in the humidity calibrator.
- Wait for 10 minutes.

- Press any key and enter the second point value and press <cr>.

```
RH  :  xx.x   Ref2 ?  yy.y <cr>
```

- The stabilization of the sensor can be monitored here as well by entering c <cr> instead of the reference value.

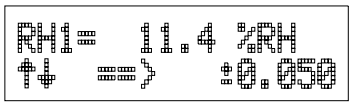
## Using display/keypad commands

- Leave the calibrator and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap on the transmitter.

**Disconnect the security lock jumper before turning the transmitter on!**

- Place the sensor head in the calibration hole of the LiCl bottle (dry end reference) in the humidity calibrator.

- Select Cali in the main menu and then RH; select Not changed and then two-point calibration RH 2 point cal. Change the first point reading with the arrow keys to correspond the reference humidity and press ENT; pressing an arrow once changes the reading by 0.05 %RH.




- Place the sensor head in the calibration hole of the NaCl bottle (wet end reference) in the humidity calibrator.

- Wait for 10 minutes.

- If necessary, change the second point reading with the arrow keys and press ENT.

## Using LED commands

- Leave the calibrator and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap on the transmitter.

**Disconnect the security lock jumper before turning the transmitter on!**

- Place the sensor head in the calibration hole of the LiCl bottle (dry end reference) in the humidity calibrator.

- Connect an ammeter/voltmeter to the analogue outputs (connector X2). Give command ○○○●. At the first calibration point the LED on the left flashes; adjust the first point (offset) with the arrow switches to the value given in the calibration table (Chapter 0) and press ENT switch.

- Place the sensor head in the calibration hole of the NaCl bottle (wet end reference) in the humidity calibrator.

- Wait for 10 minutes.

- Check that the reading corresponds within the desired accuracy to that given in the calibration table (Chapter 0). If not, adjust the second point with the arrow switches to the correct value and press ENT. At the second calibration point the second LED from the left flashes.

## Humidity calibration table

**TABLE 6-1** Greenspan's calibration table

| Temperature | °C | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|
| | °F | 59 | 68 | 77 | 86 | 95 |
| LiCl | %RH | * | 11.3 | 11.3 | 11.3 | 11.3 |
| 4...20 mA | | | 5.81 | 5.81 | 5.81 | 5.81 |
| 0...20 mA | | | 2.26 | 2.26 | 2.26 | 2.26 |
| 0...1 V | | | 0.113 | 0.113 | 0.113 | 0.113 |
| 0...5 V | | | 0.565 | 0.565 | 0.565 | 0.565 |
| 0...10 V | | | 1.13 | 1.13 | 1.13 | 1.13 |
| | | | | | | |
| NaCl | %RH | 75.6 | 75.5 | 75.3 | 75.1 | 74.9 |
| 4...20 mA | | 16.10 | 16.08 | 16.05 | 16.02 | 15.98 |
| 0...20 mA | | 15.12 | 15.10 | 15.06 | 15.02 | 14.98 |
| 0...1 V | | 0.756 | 0.755 | 0.753 | 0.751 | 0.749 |
| 0...5 V | | 3.780 | 3.775 | 3.765 | 3.755 | 3.745 |
| 0...10 V | | 7.56 | 7.55 | 7.53 | 7.51 | 7.49 |

*) If the LiCl solution is used or stored in temperature below +18 °C (+64 °F), the equilibrium humidity of the salt solution changes permanently.

# Temperature calibration

The temperature channel has been calibrated at the factory and since it is very stable, adjustment should be made only when there is strong reason to believe that the adjustments have changed.

Temperature calibration should be performed against some accurate temperature reference. It can be done either using the press switches inside the housing, through the serial bus or the menus on the local display. Either a one point offset correction or a two point calibration is possible.

## One point offset correction

### Using serial commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.

- Give command CT <cr>, enter the first point value and press <cr>:

```
>CT <cr>
T  :  xx.x   Ref1 ?  yy.y <cr>
Press any key when ready
```

- If you want to see how the sensor stabilizes to the reference temperature, enter c <cr> instead of the first reference:

```
T : 0.90  Ref1  ? c <cr>
T : 0.55  Ref1  ? c <cr>
T : 0.55 Ref1  ? 0.0 <cr>
Press any key when ready...
```

- After giving the correct temperature value (Ref1) and pressing <cr> press any key and then <cr>.

## Using display/keypad commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.

- Select Cali in the main menu and then T; select one-point calibration T 1 point cal.

- Change the reading with the arrow keys to correspond to the reference and press ENT.

## Using LED commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.

- Connect an ammeter/voltmeter to the analogue outputs (connector X2). Give command ○○●○. At the first calibration point the LED on the left flashes; adjust the first point (offset) with the arrow switches to the same reading with the reference and press ENT switch.

- After adjusting the offset point and pressing ENT the second LED from left flashes. Press ENT without changing the output value.

# Two-point temperature calibration

## Using serial commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.

- Give command CT <cr>, enter the first point value and press <cr>:

```
>CT <cr>
T  :  xx.x   Ref1 ?  yy.y <cr>
Press any key when ready
```

- If you want to see how the sensor stabilizes to the reference temperature, enter c <cr> instead of the first reference:

```
T : 0.90  Ref1  ? c <cr>
T : 0.55  Ref1  ? c <cr>
T : 0.55 Ref1  ? 0.0 <cr>
Press any key when ready...
```

- Change the temperature and again check the transmitter against the reference.

- Check that the reading corresponds with the reading of the reference instrument. If not, adjust the second point.

- Press any key, enter the second point value and press <cr>.

```
T  :  xx.x   Ref2 ?  yy.y <cr>
```

- The stabilization of the sensor can be monitored well by entering c <cr> instead of the reference value.

## Using display/keypad commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.
- Select Cali in the main menu and then T; select two-point calibration T 2 point cal. Change the first point reading with the arrow keys and press ENT.
- Change the temperature and again check the transmitter against the reference.
- Check that the reading corresponds with the reading of the reference instrument. If not, adjust the second point.
- If necessary, change the second point reading with the arrow keys and press ENT.

## Using LED commands

- Leave the reference instrument and the transmitter for at least 4 hours in the same space so that their temperatures have time to equalize. Remove the filter cap prior to calibration.

**Disconnect the security lock jumper before turning the transmitter on!**

- Check the transmitter against the reference.
- Connect an ammeter/voltmeter to the analogue outputs (connector X2). Give command ○○●○. At the first calibration point the LED on the left flashes; adjust the first point (offset) with the arrow switches to the same reading with the reference and press ENT switch.
- Change the temperature and again check the transmitter against the reference.

- Check that the reading corresponds with the reading of the reference instrument. If not, adjust the second point.

- If necessary, adjust with the arrow switches to the correct value and press ENT. At the second calibration point the second LED from the left flashes.

# Calibration of the analogue outputs

The analogue outputs have been calibrated at the factory and since they are very stable, calibration of the outputs should be performed only when there is reason to believe that their adjustments have changed.

## Using serial commands

**Disconnect the security lock jumper!**

**ACAL <cr>**

The outputs on channels 1 and 2 are measured and the measured values (mA or V) entered as calibration coefficients.

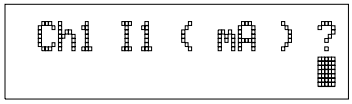
Example: both channels have 0...10 V outputs (set with AMODE command); enter the voltages measured at the analogue outputs:

```
>ACAL <cr>
Ch1  U1 ( V  ) ? 0.123 <cr>
Ch1  U2 ( V  ) ? 9.98 <cr>
Ch2  U1 ( V  ) ? 0.120 <cr>
Ch2  U2 ( V  ) ? 9.98 <cr>
```

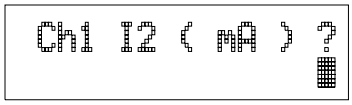
## Using display/keypad commands

**Disconnect the security lock jumper!**

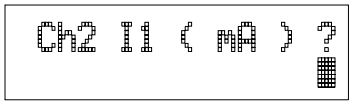
- Connect an ammeter/voltmeter to the output of channel 1, select Cali in the main menu and Analog outputs in the Cali menu. The following is displayed (the quantity can be either mA or V):



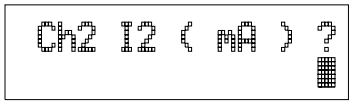

- Enter the measured lower end current/voltage on channel 1.




- Enter the measured upper end current/voltage on channel 1.




- Connect the meter to the output of channel 2 and enter the measured lower end current/voltage on channel 2.




- Enter the measured upper end current/voltage on channel 2.

## Using LED commands

If both the analogue outputs and humidity/temperature channels are calibrated, the analogue outputs should be calibrated first. This applies only when the calibrations are done using the LED commands!

- connect an ammeter/voltmeter to the analogue outputs (connector X2)

**Disconnect the security lock jumper!**

- Give command ○○●●.
- the LED on the left flashes; set the low end of channel 1 with the arrow keys and press ENT
- the second LED from the left flashes; set the high end of channel 1 with the arrow keys and press ENT

- the LED on the left flashes; set the low end of channel 2 with the arrow keys and press ENT

- the second LED from the left flashes; set the high end of channel 2 with the arrow keys and press ENT

The analogue outputs are calibrated to ensure that outputs are correctly scaled: for example, when the output is scaled to 4...20 mA, the low end of the scale is 4 mA and high end 20 mA exactly. However, when 0... 20 mA output is used, the output can not be adjusted to exactly 0 mA, but to 50 µA. When 0...1 V, 0...5 V or 0...10 V output is in use, the output is adjusted to 50 mV. The following table summarizes the correct output values.

**TABLE 6-2** Summary of the correct output values

| | Output scale: | | | | |
|---|---|---|---|---|---|
| | 0...20 mA | 4...20 mA | 0...1 V | 0...5 V | 0...10 V |
| low end: | 50 µA | 4 mA | 50 mV | 50 mV | 50 mV |
| high end: | 20 mA | 20 mA | 1 V | 5 V | 10 V |

# CHAPTER 7 MAINTENANCE

## Reference measurements

Reference measurements are needed to verify whether the transmitter readings are within specifications. This way the user can check if the transmitter needs calibration or service.

The reference measurement should be made as close to the checked sensor as possible and the readings should be read at the same time, when possible. A re-calibrated DMP248 transmitter can be used as a reference.

## Self-diagnostics

The DMP248 transmitter goes through a self-diagnostics procedure when the power is switched on. If the procedure does not reveal any errors or faults, the transmitter starts operating normally. If errors or faults are found, check first if the DRYCAP® sensor is damaged. If it is intact, send the transmitter to Vaisala or a Vaisala representative for repairs. The error messages the transmitter outputs are listed in Appendix 5.

If any errors occur during operation, the error messages are output on the local display if the transmitter displays measurements; if the menus are used, error messages are not output. The LEDs indicate errors at all times. During operation, however, the error messages are not output automatically through the serial interface. If there is any reason to doubt that there is something wrong with the transmitter, use command ERRS:

**ERRS <cr>**

If there are no error messages, only a prompt is displayed:

```
>ERRS <cr>
>
```

When errors have occurred, the transmitter outputs the error code (see Appendix 5 for all error messages):

```
>ERRS <cr>
E40  f  ( all )   out of range
>
```

# Temperature channel adjustment with Pt 100 simulators

Switch the power off and disconnect the wires to the Pt 100 sensor from solder lugs TP5, TP6 and TP7.

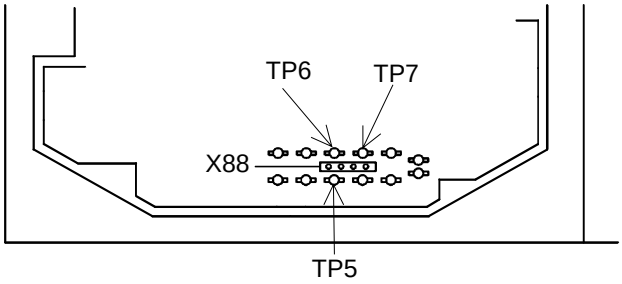



**FIGURE 7-1** Location of solder lugs TP5, TP6 and TP7 and connector X88

Connect a Pt 100 simulator to connector X88 and set it at the lowest temperature to be calibrated.

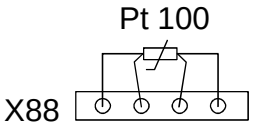



**FIGURE 7-2** Connecting the Pt 100 simulator to connector X88

Switch the power on.

## Adjustment using serial commands

Give command CT and enter the first point value and press <cr>:

```
>CT <cr>
'C  :  xx.x   Ref1 ?  yy.y <cr>
Press any key when ready
```

Set the Pt 100 simulator at the highest temperature to be calibrated, and press any key. Enter the second point (gain) reference reading. If second reference is not needed, press <cr> to complete one point offset correction.

## Adjustment using display commands

Select Cali in the main menu and then T; select two-point calibration T 2 point cal. Change the first point reading with the arrow keys and press ENT.

Set the Pt 100 simulator at the highest temperature to be calibrated, and adjust the second point (gain) to the reference reading.

## Adjustment using LED commands

Connect an ammeter/voltmeter to the analogue outputs (connector X2). Give command ○○●○, and adjust the first point (offset) with the arrow switches to the same reading with the reference and press ENT switch.

Set the Pt 100 simulator at the highest temperature to be calibrated, and adjust the second point (gain) to the reference reading. If there is no second reference, press ENT to complete one point offset correction.

Disconnect the Pt 100 simulator and reconnect the Pt 100 wires to solder lugs TP5, TP6 and TP7.

The correct connections according to the wire colours are:

| TP5 | TP6 | TP7 | TP8 |
|---|---|---|---|
| blue | green | yellow | black |

If there is not a Pt 100 simulator available, the adjustment can be made with two resistors of 84 Ω and 154 Ω whose resistance is known precisely. Measure the resistor with a resistance meter. Look up the

corresponding temperature value from a Pt 100 conversion table or calculate it using the following equation:

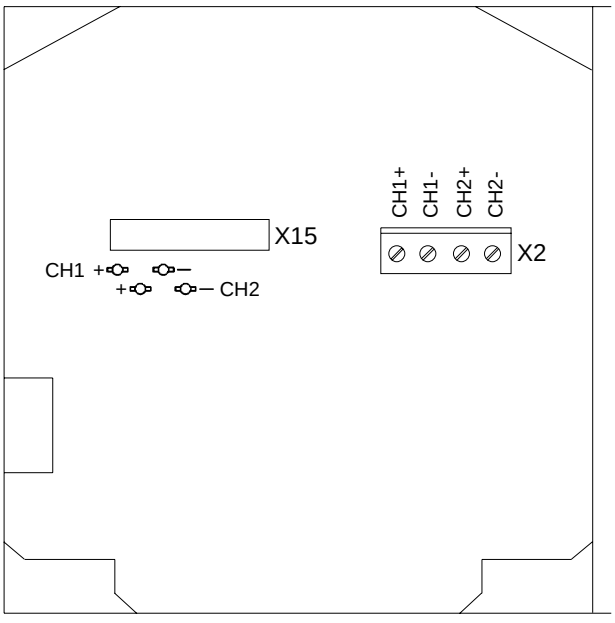
$$T = D0 + R \times \{D1 + R \times [D2 + R \times (D3 + R \times D4)]\} \quad (7\text{-}1)$$

where

| | | |
|---|---|---|
| D0 | = | -243.5673014 |
| D1 | = | 2.278542701 |
| D2 | = | 0.002050681 |
| D3 | = | -6.15025E-06 |
| D4 | = | 1.34949E-08 |

# Measurement of output currents using test points

If a current output has been connected e.g. to a process computer, the output current cannot be measured at the output connector X2 without disconnecting the external load. The output current can, however, be measured at test points CH1+/CH1- and CH2+/CH2- without disconnecting the output wires. These test points can therefore be used in one point offset correction against an accurate reference or in checking the current output without disconnecting the analogue output from the process.




OPENED COVER OF THE DMP248

**FIGURE 7-3** Location of the CH1 and CH2 test points

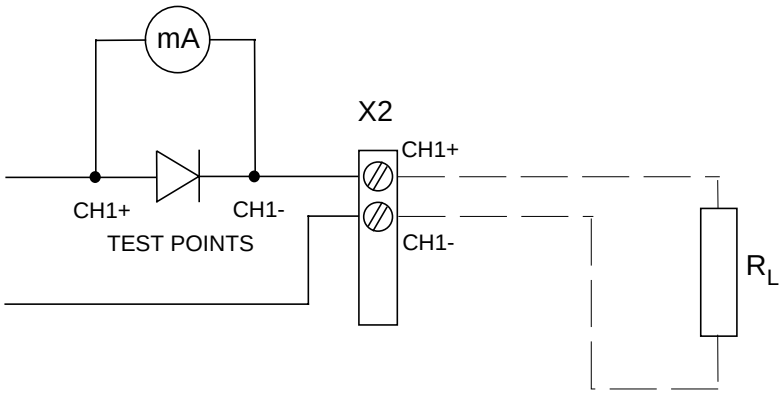



**FIGURE 7-4** Circuit diagram of the analogue output current test points

# Adjusting the contrast of the display

The contrast of the display can be adjusted using the trimmer "LCD display contrast" located next to the press switches.

# CHAPTER 8 TECHNICAL DATA

## Measured variables

### Dewpoint temperature

Measurement range -60...+80 °C
(below 0 °C DMP248 outputs frostpoint)

Dewpoint accuracy ± 2 °C (-50...+80 °C)
(see figure below)

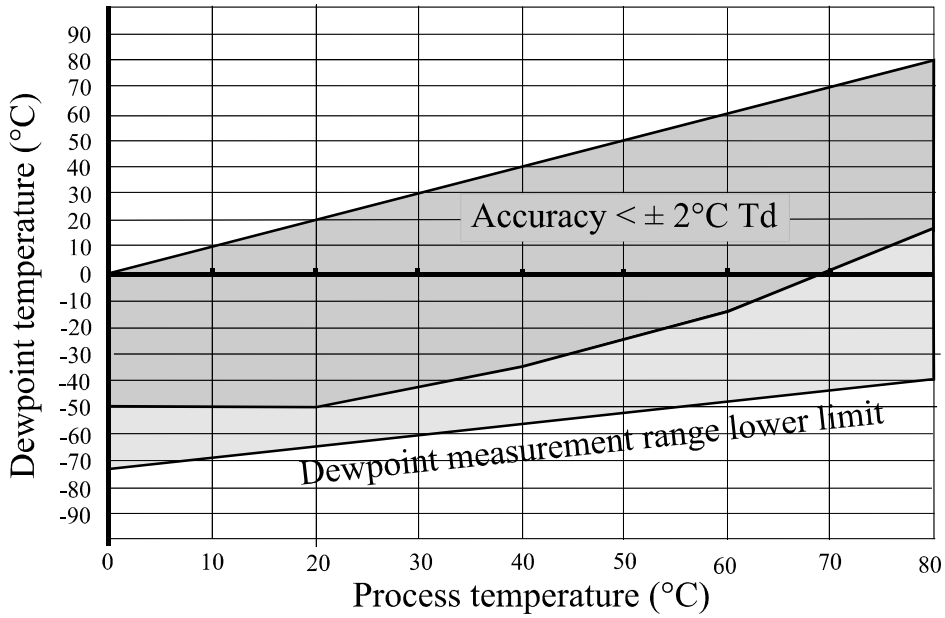



**FIGURE 8-1** Measurement range and accuracy.

Response time (90%) at flow rate 0.08 m/s
(1 bar) at 20 °C:
-40 → -20 °C dp 35 s
-20 → -40 °C dp 240 s

## Temperature

| | |
|---|---|
| Measurement range | -40...+80 °C |
| for specified Td accuracy | 0...+80 °C |
| Typical accuracy of electronics at +20 °C (+68 °F) | ±0.1 °C |
| Typical temperature dependence of electronics | 0.005 °C/°C |
| Temperature sensor | Pt 100 IEC 751 1/3 Class B |

## Relative humidity

| | |
|---|---|
| Measurement range | 0...100 %RH |
| Accuracy at 20 °C | |
| RH< 10 %RH | ± 0.025 %RH + 8.75% of reading |
| RH> 10 %RH | ± 0.7 %RH + 2% of reading |

## Ppm volume concentration (dry)

| | |
|---|---|
| Typical measurement range | 0...5000 $ppm_v$ |
| Accuracy at 20 °C, 1013.25 mbar | 7.3 $ppm_v$ + 8.3% of reading |

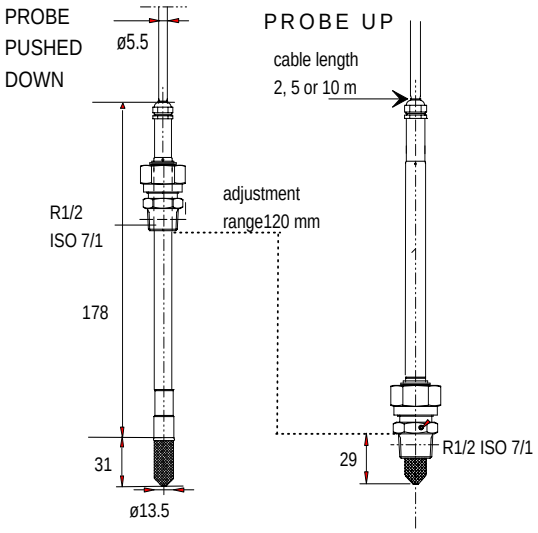
# Outputs

| | |
|---|---|
| Two analogue outputs selectable | 0...20 mA 4...20 mA<br>0...1 V 0...5 V<br>0...10 V |
| Typical accuracy of an analogue output at +20 °C | ±0.05 % full scale |
| Typical temperature dependence of an analogue output | 0.005 %/°C full scale |
| Serial outputs | RS 232C<br>RS 485 (option)<br>current loop (option) |

# General

| | |
|---|---|
| Sensor | DRYCAP® S sensor |
| Connections | screw terminals, 0.5 $mm^2$ wires (AWG 20), stranded wires recommended |
| Operating voltage | 24 VDC/ isolated VAC (20...28 V)<br>115 VAC/230 VAC with power supply module |
| Power consumption | 100 mA maximum (24 VDC) |
| Recommended external load for current outputs | <500 Ω |
| 0...1 V voltage output | >2 kΩ (to ground) |
| 0...5 and 0...10 V voltage outputs | >10 kΩ (to ground) |
| Operating temperature range (electronics) | -40...+60 °C |
| with display cover | 0...+50 °C |
| with power supply unit | -40...+45 °C |
| Storage temperature range | -40...+70 °C |
| Pressure range | 0 ...20 bar absolute pressure |
| Housing material | G-AlSi12 (DIN 1725) |
| Housing classification | IP 65 (NEMA 4) |
| Bushing | for 7...10 mm diameter cable (8 x 0.5 $mm^2$ shielded cable) |
| Sensor protection (∅13.5 mm) | stainless steel sintered filter (part no. 16452) |
| for vacuum applications | stainless steel filter (part no. HM46999 ) |
| Housing dimensions | 145 x 120 x 65 mm |

Sensor head dimensions:




| | |
|---|---|
| Weight of display cover | 420 g |

# Electronics

| | |
|---|---|
| User interface | 3 keys and 4 LEDs inside the housing or local display keypad (option) |
| Display (option) | 2 x 16 character alphanumeric LCD |
| character height | 3.85 mm (0.15") |
| Keyboard | 1 x 4 keypad |

# Serial interface modules

| | |
|---|---|
| Module types | RS 485/422<br>digital current loop |
| Connections | screw terminals for 0.5 $mm^2$ wires (AWG 20), stranded wires recommended |
| Assembly | plug-in module |
| Number of devices on line | |
| RS 485/422 | 32 |
| digital current loop | 6 (single loop)<br>9 (dual loop) |
| Network cable type | twisted pair |
| Network line length | 1000 m max. |
| Network data speed | |
| RS 485/422 | 9600 baud max. |
| digital current loop | 4800 baud max. |

# Electromagnetic compatibility

The emission and immunity tests have been performed according to standards EN50081-1 and EN50082-2.

## Emissions

| Test: | Setup according to: |
|---|---|
| Radiated interference | EN55022 (class B) |

## Immunity

| Test: | Setup according to: | Performance: |
|---|---|---|
| Electrostatic discharge | EN61000-4-2:1995 | criteria B |
| Electrical fast transients | EN61000-4-4:1995 | criteria B |
| GSM field immunity | ENV50204:1995 | criteria A |
| RF radiated fields | ENV50140:1993 | criteria A |
| RF conducted fields | ENV50141:1993 | criteria A |

Voltage proof, AC: DC supply (+ or -) to housing 250 VAC, 1 minute (300 kΩ and 15 nF parallel)

# CHAPTER 9 OPTIONS

| | |
|---|---|
| Power supply | 24 VDC (VAC)(standard),<br>115/230 VAC |
| Serial interface | RS 232C (standard), RS 485/422,<br>current loop |
| Cable length | 2, 5 or 10 metres |
| Alarm output | 2 relays 8 A/ 230 V SPCO (Single Pole Change Over) for adjustable low and high alarm |
| Display cover | cover with or without local display & keypad |

# CHAPTER 10 SPARE PARTS AND ACCESSORIES

| Order code | Description |
|---|---|
| 16452 | Sintered filter, stainless steel |
| DRYCAP S | DRYCAP® S dewpoint sensor |
| HMP230PW | Power supply module |
| 5237 | Fuse 160 mA T 5x20 mm for power supply module |
| HMP230RS | RS 485/422 serial module |
| HMP230CL | Current loop module |
| DMP240ALSP | Alarm output unit |
| 17143 | Fuse 8 A for alarm output unit |
| HMP248SC | Sample cell |
| DSS10 | Sample system |
| DMP248BVS | Ball valve set |
| 16611 | Calibration adapter for the HMK13B Calibrator |

# APPENDIX 1 SERIAL COMMANDS

**APPENDIX 1** **81**

AUTO-CALIBRATION COMMANDS 83
DRYCAL Defining the frequency of auto-calibration cycles 83
DCAL Forced auto-calibration 84
ANALOGUE OUTPUT COMMANDS 84
AMODE Setting the analogue outputs 84
ASEL Selecting the scaling the analogue output quantities 85
ASCL Scaling the analogue outputs 86
CALIBRATION COMMANDS 87
CRH Relative humidity calibration 87
CT Temperature calibration 87
ACAL Calibrating the analogue outputs 88
L Outputting linear correction coefficients 88
LI Entering linear correction coefficients 89
OUTPUT VIA THE SERIAL BUS 89
R Starting the measurement output 89
S Stopping the measurement output 90
SEND Outputting a reading once 90
DSEND Outputting readings of all connected transmitters once 90
ERRS Outputting error messages 91
ECHO Turning the serial interface echo ON/OFF 91
INTV Setting the output interval for the RUN state 91
FORM Setting the output format 92
FTIME Adding time to output 93
FDATE Adding date to output 94
SERI Serial bus settings 95
UNIT Selecting the output units 95
ADDR Setting the transmitter address 96
RESET Resetting the transmitter 96
OPERATION MODES 97
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ITEST Testing the analogue outputs 98
PRES Setting the pressure for pressure compensation and ppm calculations 99
XPRES Setting the pressure for pressure compensation and for ppm calculations temporarily 100
CDATE Entering calibration date 100
DATE Setting the date 100
TIME Setting the time 101
VERS Name and version of the programme 101
? Outputting the transmitter settings 101
?? Outputting the transmitter settings also in POLL mode 102
Setting and activating the outputs with menu commands 135
Setting and activating the outputs using an RS line 136

The commands function as described when the serial interface is in full-duplex mode and echo is on. All commands except FORM can be given in either capital or small letters.

In the commands <cr> means carriage return, <lf> line feed and <ht> horizontal tabulation.

# Auto-calibration commands

## DRYCAL Defining the frequency of auto-calibration cycles

**DRYCAL<cr>**

```
>drycal
DCAL ON
Interval min : 360 ?
Max dTdp: 2.00 ?
dTdp time s : 10
Max corr. : 0.040 ?
```

The interval parameter defines the frequency of auto-calibration cycles. When the transmitter is turned on, the first auto-calibration takes place after on hour unless the frequency has been set to less than an hour. After the first auto-calibration, the set frequency is activated and the auto-calibration takes place e.g. every six hours. If the setting is changed, it becomes valid only after the next auto-calibration has been completed. If you wish to activate it immediately, reset the transmitter or turn it off.

The Max dTdp parameter defines the maximum allowed change of the dewpoint value during the pre-defined dTdp time before auto-calibration. If the change in dewpoint value exceeds the limit, the calibration is not started. The auto-calibration is done only after process is stabilized. The dTdp defines the time for Max dTdp measurement.

The Max corr. parameter defines the maximum correction (%RH) the transmitter does during each auto-calibration cycle. The Settl time defines the time the output values (measured before auto-calibration) are frozen after the auto-calibration. The time is for sensor temperature stabilization.

**NOTE** Normally, the Max dTdp and the Max corr. parameters need not be changed.

**NOTE** Auto-calibration takes place only when the security lock jumper is connected.

## DCAL Forced auto-calibration

**DCAL<cr>**

```
>dcal
Calibration...
any key to abort
>                  (appears when the auto-calibration
                    is completed, max. 60 - 70 seconds)
```

If you press any key, the calibration is interrupted. If no key is pressed, the calibration takes place immediately. The text above is displayed during the calibration. If the process is unstable (see Chapter ) or relative humidity is over 10%, the calibration is not performed. The text above is only shortly displayed and the display returns to the measuring mode. The calibration is not performed again even if the maximum correction is exceeded.

# Analogue output commands

## AMODE Setting the analogue outputs

**Disconnect the security lock jumper!**

**AMODE a bb.bbb cc.ccc d ee.eee ff.fff <cr>**

| | | | | | |
|---|---|---|---|---|---|
| a | = | channel 1: | U | = | voltage output |
| | | | I | = | current output |
| bb.bbb | = | lower limit of channel 1 | | | |
| cc.ccc | = | upper limit of channel 1 | | | |
| d | = | channel 2: | U | = | voltage output |
| | | | I | = | current output |
| ee.eee | = | lower limit of channel 2 | | | |
| ff.fff | = | upper limit of channel 2 | | | |

The bb.bbb, cc.ccc, ee.eee and ff.fff parameters are entered in volts or milliamperes.
Sets the analogue outputs on channels 1 and 2. An example of this is when the voltage output on channel 1 is set to be 0...1 V and channel 2 set to 2...10 V:

```
>AMODE U 0 1 U 2 10 <cr>
Ch1 :  0.000 ...    1.000 V
Ch2 :  2.000 ...  10.000 V
```

The current settings can be checked by giving the command without any parameters:

>AMODE <cr>
Ch1 : 0.000 ... 20.000 mA
Ch2 : 0.000 ... 20.000 mA

## ASEL Selecting the scaling the analogue output quantities

**Disconnect the security lock jumper!**

**ASEL xxx yyy <cr>**

xxx = channel 1's quantity (Td, ppm, RH, T)
yyy = channel 2's quantity (Td, ppm, RH, T)

For example, dewpoint temperature is selected to be output on channel 1 and temperature on channel 2; the temperature range is scaled to 0...60 °C:

```
>ASEL  Td  T <cr>
Ch1  ( Td  )  lo   -50.00 'C     ? -40<cr>
Ch1  ( Td  )  hi    10.00 'C     ?   0<cr>
Ch2  ( T   )  lo    10.00 'C     ?   0<cr>
Ch2  ( T   )  hi   100.00 'C     ?  60<cr>
>
```

When the ASEL command is given on its own, the transmitter outputs its current settings:

```
>ASEL <cr>
Ch1  ( Td )  lo   -50.00 'C    ? <cr>
Ch1  ( Td )  hi    10.00 'C    ? <cr>
Ch2  ( T  )  lo    10.00 'C    ? <cr>
Ch2  ( T  )  hi   100.00 'C    ? <cr>
```

The outputs and their scales can also be given directly with the ASEL command.

**ASEL xxx yyy aaa.a bbb.b ccc.c ddd.d <cr>**

xxx = channel 1's quantity
yyy = channel 2's quantity
aaa.a = lower limit of channel 1
bbb.b = upper limit of channel 1
ccc.c = lower limit of channel 2
ddd.d = upper limit of channel 2

## ASCL Scaling the analogue outputs

**Disconnect the security lock jumper!**

**ASCL <cr>**

Scales the outputs selected on channels 1 and 2.
For example, scaling dewpoint temperature on the range of -40...0 °C and temperature 0...+60 °C:

```
>ASCL <cr>
Ch1  ( Td )  lo   -50.00 'C     ? -40<cr>
Ch1  ( Td )  hi    10.00 'C     ?   0<cr>
Ch2  ( T  )  lo    10.00 'C     ?   0<cr>
Ch2  ( T  )  hi   100.00 'C     ?  60<cr>
>
```

The output scales can also be given directly with the ASCL command.

**ASCL aaa.a bbb.b ccc.c ddd.d <cr>**

aaa.a = lower limit of channel 1
bbb.b = upper limit of channel 1
ccc.c = lower limit of channel 2
ddd.d = upper limit of channel 2

For example, when dewpoint temperature is scaled to -40...0 °C on channel 1 and temperature to 0...+60 °C on channel 2:

```
>ASCL -40  0  0  60 <cr>
Ch1  ( Td )  lo   -40.00 'C     ? <cr>
Ch1  ( Td )  hi     0.00 'C     ? <cr>
Ch2  ( T  )  lo     0.00 'C     ? <cr>
Ch2  ( T  )  hi    60.00 'C     ? <cr>
>
```

# Calibration commands

## CRH Relative humidity calibration

**Disconnect the security lock jumper!**

**CRH <cr>**

With this command the transmitters can be calibrated against two RH references. Two-point calibration is performed using saturated salt solutions in controlled conditions according to the following instructions:

```
>CRH <cr>
RH  :  12.00   Ref1 ?  11.3 <cr>
Press any key when ready ...
RH  :  76.00   Ref2 ?  75.5 <cr>
```

If the stabilization of the sensor to the humidity in the calibrator needs to be monitored, the measurement output can be repeated by giving command c<cr> at Ref1 and Ref2:

```
>CRH <cr>
RH  :  12.00  Ref1 ?  c <cr>
RH  :  11.70  Ref1 ?  c <cr>
RH  :  11.50  Ref1 ?  11.3 <cr>
Press any key when ready ...
RH  :  76.00  Ref2 ?  75.5 <cr>
```

## CT Temperature calibration

**Disconnect the security lock jumper!**

**CT <cr>**

Using this command the transmitters can be calibrated against an accurate reference, such as a Pt 100 simulator. A two-point calibration is performed as follows:

```
>CT <cr>
T  :  0.80    Ref1 ?   0.0 <cr>
Press any key when ready ...
T  :  56.20   Ref2 ?   55.0 <cr>
```

In one-point offset correction, the Ref2 prompt is acknowledged with <cr>:

```
>CT <cr>
T  :  0.80    Ref1 ?   0.0 <cr>
Press any key when ready ...
T  :  75.50   Ref2 ?   <cr>
```

If the stabilization of the sensor to the temperature of the calibrator or the reference needs to be monitored, the measurement output can be repeated by giving command c<cr> at Ref1 and Ref2:

```
>CT <cr>
T  :  0.80    Ref1 ?   c <cr>
T  :  0.40    Ref1 ?   0.00 <cr>
Press any key when ready ...
T  :  56.20   Ref2 ?   55.0 <cr>
```

## ACAL Calibrating the analogue outputs

**Disconnect the security lock jumper!**

**ACAL <cr>**

Calibrates the outputs selected on channels 1 and 2. The output is measured and the measured values (mA or V) entered as calibration coefficients.
For example, calibrating the outputs when 0...10 V signal has been selected on both channels (set with AMODE command)

```
>ACAL <cr>
Ch1  U1   (V  ) ?  0.123 <cr>
Ch1  U2   (V  ) ?  9.98 <cr>
Ch2  U1   (V  ) ?  0.120 <cr>
Ch2  U2   (V  ) ?  9.98 <cr>
```

## L Outputting linear correction coefficients

**L <cr>**

Calibration coefficients can be checked with command L.

```
>L <cr>
RH   offset   : 0.000
RH   gain     : 1.000
Ts    offset  : 0.000
Ts   gain     : 1.000
```

## LI Entering linear correction coefficients

**Disconnect the security lock jumper!**

**LI <cr>**

The LI command is one way of calibrating the transmitters.

```
>LI <cr>
RH   offset   : 0.000  ?  -.6 <cr>
RH   gain     : 1.000  ? <cr>
Ts   offset   : 0.000  ? <cr>
Ts   gain     : 1.000  ?  .4 <cr>
```

The factory settings are offset 0 and gain 1.

**NOTE** The temperature unit in offset correction is always degrees Centigrade, even if the transmitter is using non-metric units (Fahrenheit) in its measurement output.

# Output via the serial bus

## R Starting the measurement output

**R <cr>**

Starts output of measurements to the peripheral devices (PC display or printer); output interval is set with command INTV.

Factory setting of the output format:

```
Td= -9.3 'C PPM=   2733 T= 22.1 'C RH= 10.4 %RH
Td= -9.3 'C PPM=   2730 T= 22.1 'C RH= 10.4 %RH
...
```

When the transmitter sends out the readings, the serial interface does not echo any commands; the only command that can be used is S (stop).
The output format can be changed with command FORM.

## S Stopping the measurement output

**S<cr>**

Ends the RUN state; after this command all other commands can be used.

## SEND Outputting a reading once

**SEND <cr> in STOP state**

or

**SEND aa <cr> in POLL state**

aa = address of the transmitter when more than one transmitter is connected to a serial bus (0...99; set with command ADDR)

Outputs the current measurement readings via the serial line. The output type is the following:

```
Td= -9.3 'C PPM=   2733 T= 22.1 'C RH= 10.4 %RH
Td= -9.3 'C PPM=   2730 T= 22.1 'C RH= 10.4 %RH
...
```

The output format can be changed with command FORM.

## DSEND Outputting readings of all connected transmitters once

**DSEND <cr>**

All transmitters connected to the serial bus send their addresses and current measurement readings in an order defined by their addresses. After receiving DSEND command a transmitter sets a delay time according to its address value and sends the data after this delay. DSEND works also in POLL mode. With this command, the user can for example easily find out the addresses of the transmitters.
The output when four transmitters with addresses 4, 5, 10, 33 have been connected to the serial bus:

```
>dsend <cr>
4    14.43 %RH
5    22.7 'C
10   14.99 %RH
33   22.3 'C
>
```

## ERRS Outputting error messages

**ERRS <cr>**

During operation error messages are not output automatically through the serial interface. If there is any reason to doubt that there is something wrong with the transmitter, possible error messages can be output with command ERRS.

If there are no error messages, only a prompt is displayed:

```
>ERRS <cr>
>
```

If errors have occurred, the transmitter outputs the error code (see Appendix 5 for error messages):

```
>ERRS <cr>
E40  f  ( all )  out of range
>
```

## ECHO Turning the serial interface echo ON/OFF

**ECHO xxx <cr>**

xxx = ON or OFF

When the echo is off, the commands given through the serial interface or the prompt > cannot be seen on the display.
When the serial interface is in half-duplex mode, the echo is always off. Even then the ECHO command can indicate that echo is on.

## INTV Setting the output interval for the RUN state

**INTV xxx yyy <cr>**

| | |
|---|---|
| xxx = | output interval (0...255) |
| | 0: no pause between outputs |
| yyy = | unit (s, min or h) |

Sets the output interval when the transmitter outputs measurement readings to a peripheral device.
For example, the currently valid settings are output with:

```
>INTV <cr>
Output intrv. :  0 min
```

When this is changed into 10 minutes, the command is:

```
>INTV 10 <cr>
Output intrv. :  10 min
```

The unit is changed into seconds with:

```
>INTV S <cr>
Output intrv. :  10 s
```

The change can also be done with one command:

```
>INTV 10 S <cr>
Output intrv. :  10 s
```

## FORM Setting the output format

**FORM <cr>**
**"xxx...xxx"**
**? zzz...zzz <cr>**

| | | |
|---|---|---|
| xxx...xxx | = | old format |
| zzz...zzz | = | new format |

The FORM command sets the format of the outputs generated in RUN state and by SEND command.

**NOTE** Please note that capital and small letters have different meanings.

| | |
|---|---|
| \DD..DD\ | dewpoint temperature |
| \TT..TT\ | temperature |
| \UU..UU\ | relative humidity |
| \MM..MM\ | ppm concentration |
| \PP..PP\ | absolute pressure (hPa) (manually feeded value) |
| \uu..uu\ | unit according to the preceding variable |
| \n | line feed <lf> |
| \r | carriage return <cr> |
| \t | horizontal tabulation <ht> or <tab> |
| \\ | \ |

For example:

| format | output |
|---|---|
| \UUU.UU\ \+TT.TT\\r | 100.00 +99.99 <cr> |
| \TTT.T\ \uu\\r\n | 15.2 'C <cr><lf> |
| \UUU.U\ \uuu\\+DD.D\ \uu\\r | 46.9 %RH +10.8 'C <cr> |

Any text can be written in the command and it appears in the output. For example:

```
RH: \UUU.U\ T: \+TT.TT\\r       RH: 54.0  T: +25 <cr>
```

The format can be deleted by giving \ as a parameter:

```
>FORM \<cr>                    Note. only one space before \ and none after
or
>FORM <cr>
"xxx...xxx"
?\<cr>
```

An example of a format suitable for use in Microsoft Excel spreadsheets:

```
>FORM <cr>
"xxx...xxx"
?\UUU.U\\t\TTT.T\\t\DDD.D\\t\\r\n <cr>
```

The output is then:

```
47.4<tab> 22.4 <tab> 10.6 <tab> <cr><lf>
```

## FTIME Adding time to output

**FTIME xxx <cr>**

xxx = ON or OFF

When FTIME is activated, the current time is output at the beginning of the output line. The time is set with command TIME. After RESET or power on the current time is 00:00:00.
Activating the time output

```
>ftime on
Form. time    :  ON
>intv 5 s                                  setting the output interval
Output intrv. :     5 s
>r
09:31:13 RH= 19.4 %RH T= 26.0 'C
09:31:18 RH= 19.4 %RH T= 26.0 'C
09:31:23 RH= 19.8 %RH T= 26.0 'C
09:31:28 RH= 19.6 %RH T= 26.0 'C
09:31:33 RH= 19.5 %RH T= 26.0 'C
09:31:38 RH= 19.5 %RH T= 26.0 'C
...
```

Inactivating the time output

```
>ftime off
Form. time    :  OFF
>r
RH= 19.4 %RH T= 26.1 'C
RH= 19.8 %RH T= 26.1 'C
RH= 20.6 %RH T= 26.1 'C
RH= 20.5 %RH T= 26.1 'C
RH= 19.9 %RH T= 26.1 'C
RH= 19.6 %RH T= 26.1 'C
...
```

## FDATE Adding date to output

**FDATE xxx <cr>**

xxx = ON or OFF

When FDATE is activated, the current date is output at the beginning of the output line. The date is set with command DATE. After RESET or power on the current date is 1991-01-01.
Activating the date output

```
>fdate on
Form. date    :  ON
>r
1995-03-10 RH= 21.1 %RH T= 26.0 'C
1995-03-10 RH= 21.3 %RH T= 26.0 'C
1995-03-10 RH= 23.1 %RH T= 26.0 'C
1995-03-10 RH= 22.2 %RH T= 26.0 'C
1995-03-10 RH= 20.6 %RH T= 26.0 'C
...
```

Inactivating the date output

```
>fdate off
Form. date    :  OFF
>r
RH= 20.2 %RH T= 26.0 'C
RH= 19.9 %RH T= 26.0 'C
RH= 19.8 %RH T= 26.0 'C
RH= 19.7 %RH T= 26.0 'C
RH= 19.7 %RH T= 26.0 'C
...
```

## SERI Serial bus settings

**SERI b p d s x <cr>**

| | | |
|---|---|---|
| b | = | bauds (300, 600, 1200, 2400, 4800, 9600) |
| p | = | parity (n = none, e = even, o = odd) |
| d | = | data bits (7 or 8) |
| s | = | stop bits (1 or 2) |
| x | = | duplex (H = half, F = full) |

Giving the command on its own outputs the current settings:

```
>SERI <cr>
4800 E 7 1 FDX
```

The settings can be changed one parameter at a time or all parameters at once:

```
>SERI O H <cr>              changing parity and duplex
4800 O 7 1 HDX

>SERI 600 N 8 1 F <cr>      changing all parameters
600 N 8 1 FDX
```

The processor does not allow the following combinations:

- no parity, 7 data bits, 1 stop bit: if this combination is given the DMP248 programme will change the number of stop bits to 2
- even or odd parity, 8 data bits, 2 stop bits: if this combination is given the programme changes the number of stop bits to 1

**NOTE** The serial bus settings become effective only after reset.

When the half-duplex mode is set, it will automatically turn the echo off. Even then the ECHO command can indicate that echo is on.

## UNIT Selecting the output units

**UNIT x <cr>**

| | | |
|---|---|---|
| x | = | m(etric units)<br>n(on-metric units) |

| | metric units | non-metric units |
|---|---|---|
| Td | °C | °F |
| T | °C | °F |
| RH | %RH | %RH |

For example, the command for setting the non-metric units is:

```
>UNIT N <cr>
Output units : non metric
```

When the command is given with no parameters, the transmitter outputs the currently valid setting.

## ADDR Setting the transmitter address

**ADDR aa <cr>**

aa = address (0...99)

The address is used when more than one transmitter is connected to one serial bus. The ADDR command makes it possible to communicate with one transmitter at a time in POLL state.

For example, transmitter is given address 99

```
>ADDR <cr>
Address     :      2 ?  99 <cr>
```

When asking the current address, no address number is given:

```
>ADDR <cr>
Address       :        2 ? <cr>
```

## RESET Resetting the transmitter

**RESET <cr>**

Resets the transmitter. All settings that have been changed stay in the memory even after reset or power failure.

# Operation modes

## SMODE Setting the serial interface

**SMODE xxxx<cr>**

xxxx = STOP, RUN or POLL

In STOP mode: measurements output only by command, all commands can be used
In RUN mode: outputting automatically, only command S can be used
In POLL mode: measurements output only with command SEND. When in POLL mode, the output state is changed as follows:

**OPEN aa <cr>**
**SMODE xxxx<cr>**

aa = address of the transmitter
xxxx = STOP, RUN or POLL

The OPEN command sets the bus temporarily in STOP MODE so that the SMODE command can be given. For example:

```
>SMODE <cr>                    which mode is in use at the moment
Serial mode    : STOP
>SMODE STOP <cr>               setting STOP mode
Serial mode    : STOP
```

## OPEN & CLOSE

**OPEN nn <cr>**

nn = address of the transmitter (0...99)

**CLOSE <cr>**

In STOP mode: command OPEN has no effect, CLOSE sets the transmitter in POLL mode
In POLL mode: command OPEN sets the transmitter temporarily in STOP mode, command CLOSE returns the instrument to POLL mode

When more than one transmitter is connected to the same serial bus, the POLL mode makes it possible to communicate with the transmitters. For example, a relative humidity calibration is performed at transmitter 2 (<bel> = ASCII 7):

```
>OPEN 2 <cr>
<cr><lf> 'DMP nn line opened for operator commands'
<cr><lf><lf><bel>
>CRH <cr>
...
>CLOSE <cr>
<cr><lf> 'line closed' <cr><lf>
```

# Others

## ITEST Testing the analogue outputs

**ITEST <cr>**

or

**ITEST a b <cr>**

a = current/voltage of channel 1
b = current/voltage of channel 2

The operation of the analogue outputs can be tested by forcing the outputs to given values which can then be measured with a current/voltage meter from the analogue outputs. The response to ITEST command gives six outputs/parameters. Only the first two are relevant; they show the channel current or voltage in mA or V. The other four figures contain information for service purposes only.
Examples:

- reading the channel outputs and parameters

```
>itest <cr>
  1.9438  2.3483  1.00694 10.64634  1.97374  2.17665
>
```

- forcing outputs 0.5 V and 4 V to channels 1 and 2

```
>itest 0.5 4 <cr>
  0.5000  4.0000  1.00694 10.62970  1.23336  3.01722
>
```

- releasing the forced control and reading the outputs

```
>itest <cr>
  1.9427  2.3392  1.00731 10.62428  1.97157  2.16978
>
```

# PRES Setting the pressure for pressure compensation and ppm calculations

**PRES pppp.pp <cr>**

pppp.pp = absolute pressure (hPa)

If the process pressure differs from the normal ambient pressure, the value has to be entered in the transmitter memory in order to ensure the best possible accuracy. The pressure setting is used for pressure compensation of the DMP248 transmitter. The pressure also strongly effects the $ppm_v$ value. The pressure is always given in hPa/mbar; for pressure conversion, see Appendix 8. When the command is given, the transmitter first gives the currently used pressure; after this a new value can be entered or the old one acknowledged.

```
>PRES <cr>
Pressure   :  1013.25  ?  1000.00 <cr>
```

When the currently used pressure is known, a new pressure can also be entered directly:

```
>PRES 1010 <cr>
Pressure   :  1010
```

**NOTE** If the security lock jumper is not connected, the pressure compensation is made with the value 1013.25 hPa.

**NOTE** If the pressure setting is frequently adjusted, e.g. by using an external barometer as a pressure input source, the command XPRES is recommended.

## XPRES Setting the pressure for pressure compensation and for ppm calculations temporarily

**XPRES pppp.pp <cr>**

pppp.pp = absolute pressure (hPa)

The function and format of XPRES are the same as those of the PRES command except that by using XPRES, the setting is valid only until a reset is given, or power is turned off or pressure is set to zero using XPRES. After this, the pressure stored using command PRES is valid again.

## CDATE Entering calibration date

**CDATE xxxxxx <cr>**

xxxxxx = calibration date (000101...991231)

When the latest calibration date has to be kept in memory, it is entered as follows:

```
>CDATE 940506 <cr>
```

If the command is given without the date, the transmitter outputs the latest calibration already in memory.

```
>CDATE <cr>
940420
```

The date can be given in any format; however, the maximum number of digits is six.

## DATE Setting the date

**DATE <cr>**

For example, to enter a new date:

```
>DATE <cr>
Current date is 1993-01-30
Enter new date (yyyy-mm-dd) : 1993-06-12 <cr>
```

When the current date is asked, the new date is passed with <cr>.

## TIME Setting the time

**TIME <cr>**

For example, to enter a new time:

```
>TIME <cr>
Current time is 01:35:54
Enter new time (hh:mm:ss) : 13:25:56 <cr>
```

When the current time is asked, the new time is passed with <cr>.

## VERS Name and version of the programme

**VERS <cr>**

For example:

```
>VERS <cr>
DMP248 / x.yy
```

where x.yy is the programme version.

## ? Outputting the transmitter settings

**? <cr>**

For example:

```
>? <CR>

DMP248 / 1.01
CPU serial nr : A1234567
Keyboard type : 0
Address       : 0
Output units  : metric
Baud P D S    : 4800 E 7 1 FDX
Serial mode   : STOP
Output intrv. : 0 s
Mtim          : 32
Pressure (hPa): 1013.25
Analog outputs
 Ch1   0.00 ... 20.00 mA
 Ch2   0.00 ... 20.00 mA
 Ch1  ( Td ) lo   -40.00 'C
 Ch1  ( Td ) hi   100.00 'C
 Ch2  ( T  ) lo   -40.00 'C
 Ch2  ( T  ) hi   160.00 'C
PRB serial nr : 9619
PRB cal. date : 960611
>
```

## ?? Outputting the transmitter settings also in POLL mode

**?? <cr>**

Command ?? outputs the same information as command ? but it works also when the transmitter has been set to POLL mode. However, if there are more than one addressed transmitters connected to the serial bus, they all will respond at the same time and the output on the screen will be chaotic.

# APPENDIX 2

## POWER SUPPLY MODULE

**APPENDIX 2 ..... 103**

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# Power supply module

## Installing the power supply module

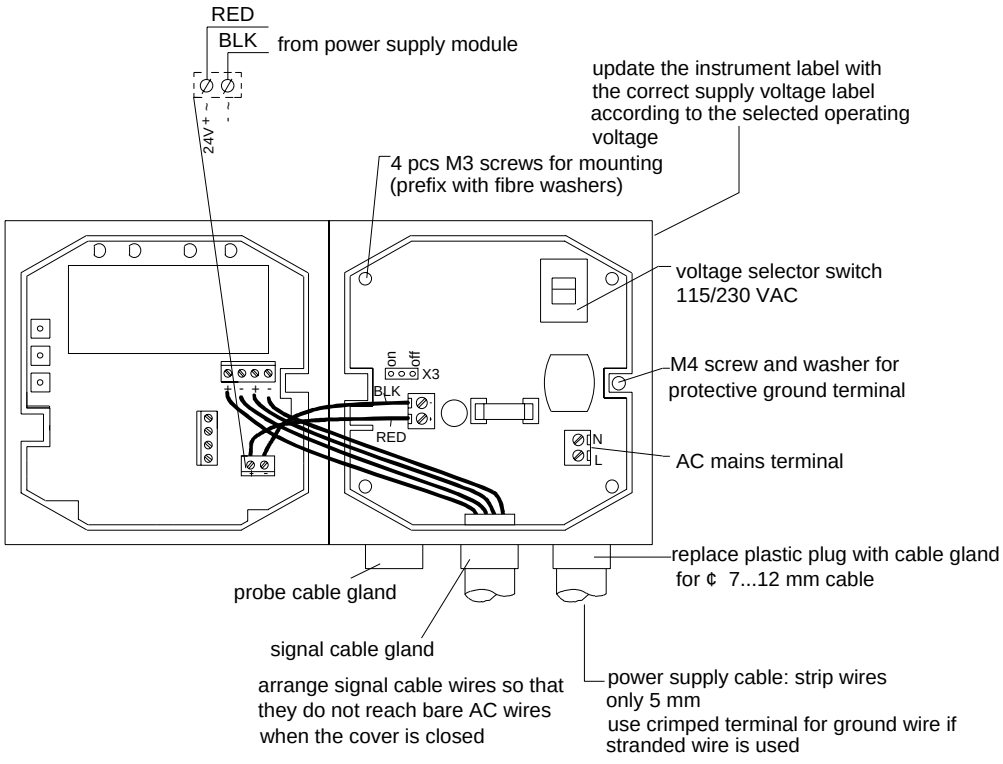
The mains power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring (IEC 950).

Remove the plastic plug in the transmitter housing and replace it with the cable gland. Fasten the power supply module to the bottom of the housing with four screws; select the correct mains voltage with voltage selector switch (230/115).

Attach the grounding wire screw and washer to the grounding terminal on the right-hand side of the module. Attach the wires from the power supply module to the power terminal on the main board of the transmitter.

| **NOTE** | The jumper in connector X3 has to be in position ON; otherwise no power is supplied to the transmitter. |
|---|---|

When the power supply module is on, the power on LED is lit.


RED
BLK
from power supply module
24V+ ~ - ~
update the instrument label with the correct supply voltage label according to the selected operating voltage
4 pcs M3 screws for mounting (prefix with fibre washers)
voltage selector switch 115/230 VAC
on
off
X3
BLK
RED
M4 screw and washer for protective ground terminal
N
L
AC mains terminal
replace plastic plug with cable gland for ¢ 7...12 mm cable
probe cable gland
signal cable gland
arrange signal cable wires so that they do not reach bare AC wires when the cover is closed
power supply cable: strip wires only 5 mm
use crimped terminal for ground wire if stranded wire is used

Peel the correct power supply voltage from the sticker enclosed in the power supply module package and attach it on the instrument label to indicate that the supply voltage has been changed.

**WARNING** Do not detach the power supply module from the transmitter when the power is on.

**WARNING** Do not connect the power supply to mains when it is not installed in a DMP248 transmitter.

# Technical specifications

| | |
|---|---|
| Operating voltage | 115 VAC (93...127 V)<br>230 VAC (187...253 V) |
| Connections | screw terminals for 0.5...<br>2.5 $mm^2$ wire (AWG 20...14) |
| Bushing | for 7...12 mm diameter cable |
| Indicator | PWR ON LED on power supply module board |
| Operating temperature range | -40...+45 °C |
| Storage temperature range | -40...+70 °C |

# APPENDIX 3

## INSTALLING AND USING THE RS 485/422 SERIAL PORT MODULE

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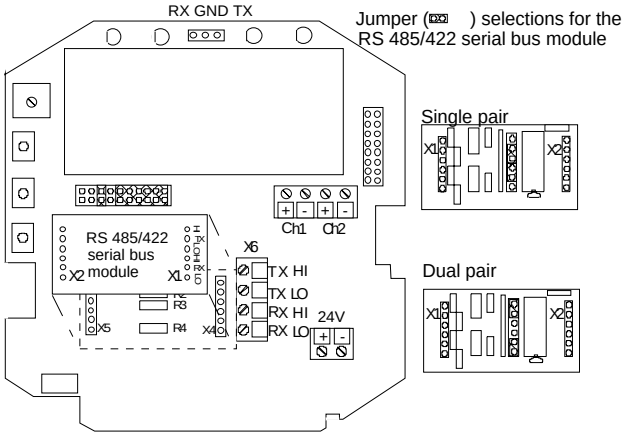
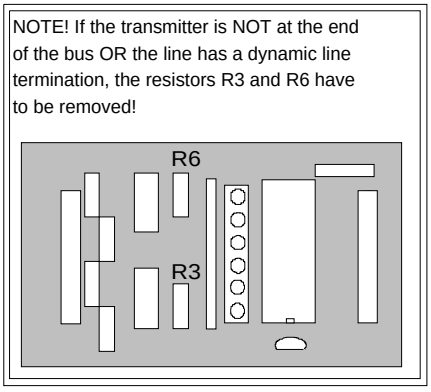
# Installation

Switch the transmitter off.

Resistors R2, R3 and R4 between connectors X4 and X5 in the component board in the cover of the transmitter are removed with side-cutting pliers. The module is plugged in connectors X4 and X5 on the main board of the DMP248 transmitter; connector X1 on the module board to connector X4 and connector X2 to connector X5.




Cut off the resistors R2, R3 and R4 on the main board.
New signal names for X6 screw terminal are on the module.
Follow the instructions on the module:
X1 to X4 and
X2 to X5 on the mother board


NOTE! If the transmitter is NOT at the end
of the bus OR the line has a dynamic line
termination, the resistors R3 and R6 have
to be removed!
R6
R3

Connect the data wires to screw terminal X6 on the main board.
Switch the power on.

# Operation

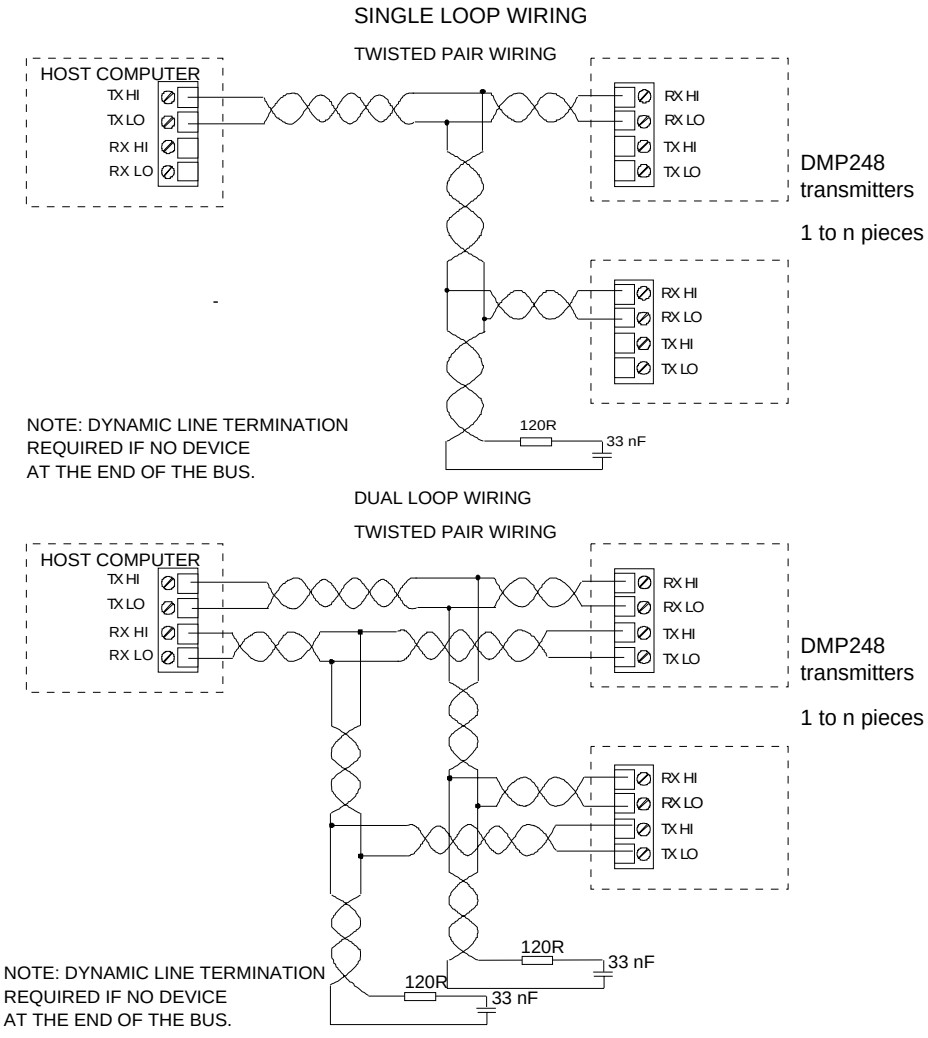
The DMP248 transmitters can either be given an address or operated without an address. Both single and dual loop wiring with half duplex

connection can be used. No address is needed when only one DMP248 transmitter is used; when several transmitters are connected to the same line, each transmitter must be given an address in the initial configuration.

A single transmitter can get its operating voltage from the master or it can have its own (floating) power supply or it has the power supply module in use.

The serial line structure is a parallel interfaced chain (daisy chain). At the ends of the serial line there must be a DMP248 transmitter, dynamic line adapter (120 ohm resistor in series with a 33 nF capacitor) or line master. If a branch line is made with a junction box, the branch should be shorter than 3 meters.

When connecting the device, follow the instructions given in the figure in Chapter 1.



The RS 485/422 module has separate lines for transmitting and receiving, but they can be connected together with jumpers. Dual loop connection is the factory setting; when a single loop connection is used, the positions of jumpers in connector X4 on the module must be changed.

The HI of the receiving line is approx. 0.6 V and its LO is approx. 0 V in order to reduce noise on the lines when no data is transferred (idling). Both lines are terminated with a 120 ohm resistor in series with a 33 nF capacitor. When operating the transmitter through a single pair, naturally only one line terminal impedance is in use. The line must not be terminated with a resistor alone, as then the power consumption increases too much.

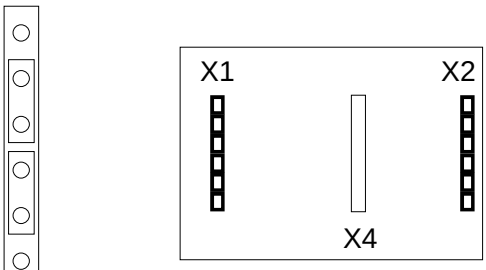
The data lines can withstand short circuit to ground and to each other. They do not survive connection of supply voltage to the data lines.

The module must be mounted on the main board in the right direction. It can be mounted in the wrong direction or to the wrong pins without breaking the module; it simply does not work then.

# Network configuration

## Single loop operation

Bi-directional data on one pair is one of the great advantages of the RS 485 line. Set jumpers in connector X4 on the module board as shown in the figure below.



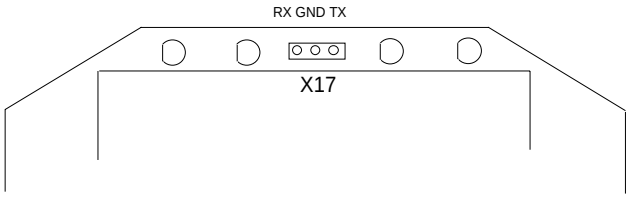

This jumper setting connects RX HI to TX HI and RX LO to TX LO and selects only one common line termination. The HI and LO terminals of the RX pair can now be used for operation.

Supplying power from the same end to the whole network prevents common mode voltages from rising too high (over 7 V).

- Connect wires to the transmitter's serial connector.
- Check the wiring.

The following procedure must be repeated with all transmitters.

- Open the transmitter cover.
- Pull out the RS 485/422 serial port module, if it is already mounted.
- Set the serial port of the terminal to 4800 baud, even parity, seven data bits and one stop bit, full duplex (4800 E 7 1 FDX).




- The serial settings of the transmitter must also be 4800 E 7 1 FDX and the transmitter must be in STOP mode. If these factory settings have been changed, they must be changed back. Connect the RS 232C port of the terminal to connector X17 on the top of the main board and switch the power on.
- Set the address of the transmitter; it can be any number between 1 and 99. In this example the address is 22:

```
>addr 22
Address       :       22
```

- Set the serial bus settings according to your network specifications. This setting will become valid after next RESET or power off:

```
>seri 2400 e 7 1 h
2400 E 7 1 HDX
```

- Set the transmitter in POLL mode:

```
>smode poll
Serial mode   : POLL
```

**NOTE** The SMODE command must be given last.

| **NOTE** | The transmitter outputs no prompt (>) after the SMODE POLL command and it only reacts to commands which include its address. |
|---|---|

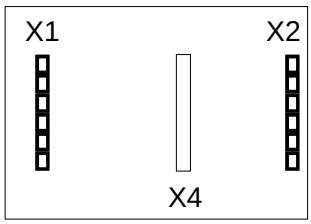
- Check that the transmitter responds to its address:

```
>send 22
Td= -47.4 'C T= 29.1 'C
```

- Disconnect the terminal.

- Check that the jumpers in connector X4 are in the right places.

X4




- Remount the RS 485/422 serial module.

- Close the cover.

- When all transmitters on the network have been configured, switch them off.

## Dual loop operation

The following procedure must be repeated with all transmitters.

- Open the transmitter cover.

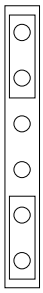
- Pull out the RS 485/422 serial port module, if it is already mounted.

- Set the serial port of the terminal to 4800 baud, even parity, seven data bits and one stop bit, full duplex (4800 E 7 1 FDX).

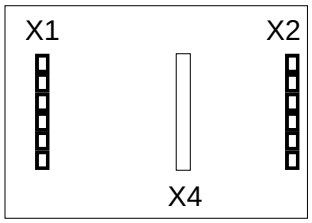
- The serial settings of the transmitter must also be 4800 E 7 1 FDX and the transmitter must be in STOP mode. If these factory settings have been changed, they must be changed back. Connect the

RS 232C port of the terminal to connector X17 on the top of the main board and switch the power on.

When dual loop is used, the jumpers in connector X4 on the module board must be as shown below.



X4




- Set the address of the transmitter, it can be any number between 1 and 99. In this example the address is 22:

```
>addr 22
Address    :    22
```

- Set the serial bus settings according to your system. This setting will become valid after next RESET or power off:

```
>seri 2400 e 7 1 f
2400 E 7 1 FDX
```

- Switch echo on:

```
>echo on
ECHO       :   ON
>
```

- Change the serial output mode into POLL:

```
>smode poll
Serial mode   : POLL
```

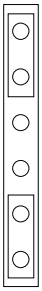
**NOTE** The SMODE command must be given last.

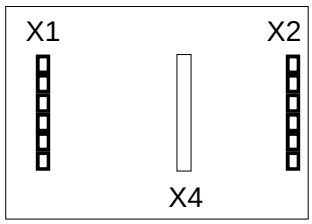
**NOTE** The transmitter outputs no prompt (>) after the SMODE POLL command and it only reacts to commands which include its address.

- Check that the transmitter responds to its address:

```
>send 22
RH= 24.4 %RH T= 29.1 'C
```

- Disconnect the terminal.
- Check that the jumpers in connector X4 are in the right places.






X4

- Remount the RS 485/422 serial module.
- Close the cover.
- Repeat this setting procedure with each transmitter.
- When all transmitters on the network have been configured, switch them off.

# Checking the serial port network operation

Normally measurement readings are asked when the transmitter is in POLL mode; then the command must include the address of the transmitter. If the settings of the transmitter need to be changed, the transmitter is switched to STOP mode with command OPEN; commands can then be given without address. When the line to the transmitter is closed, it returns to POLL mode.

## STOP mode

Open the line to the transmitter:

```
open 22<cr>
DMP 22 line opened for operator commands
```

Transmitter no. 22 is now temporarily set to STOP mode; it accepts commands sent without address until CLOSE command is given. Individual settings can now be easily modified. Do not open more than one line at a time.

Use command ? to find out the settings of the active transmitter:

```
? <cr>
DMP248 / 1.01
CPU serial nr :  0
Keyboard type :  0
Address   :  7
Output units  :  metric
Baud P D S    :  4800 E 7 1 FDX
Serial mode   :  STOP
Output intrv. :  0 min
Mtim      :  32
Pressure  :  1013.25
Analog outputs
Ch1   0.00 ...  10.00 V
Ch2   0.00 ...  10.00 V
Ch1  ( RH )   lo   0.000 %RH
Ch1  ( RH )   hi   100.000 %RH
Ch2  ( T  )   lo   -20.000 'C
Ch2  ( T  )   hi   180.000 'C
Transducer    :
PRB serial nr :  0
Calibr. date  :  0
```

When the necessary settings have been given, close the line to transmitters (the command closes all open lines):

```
>close
line closed
```

CLOSE command is always given without address. If no lines are open, there will be no response to the CLOSE command.

## POLL mode

If a transmitter has been set to POLL mode, it will respond only to commands which include its address:

```
send 22
Td= -47.4 'C T= 29.1 'C
```

Addresses from 1 to 99 can be used. According to the RS 485/422 standard a maximum of 32 devices can be connected on same bus, but the number can be increased if the line length and/or baud rate is reduced.

The line terminations must be dynamic; e.g. an RC circuit is used instead of a simple resistor termination. Each RS 485 module has a dynamic line termination so it can be used at the end of a line.

## RS 485 network settings

| DMP248 settings | single pair | dual pair |
|---|---|---|
| Full duplex/half duplex | HDX | FDX |
| Echo on/off | OFF | ON |

| Terminal settings | single pair | dual pair |
|---|---|---|
| Line feed after carriage return | yes | no |
| HDX/FDX | FDX | FDX |

When terminal is set to general <lf> (line feed) after <cr> (carriage return), the listings will have two line feeds when also the DMP248 transmitters send line feed.

# Specifications

| | |
|---|---|
| Connections | Berg sockets |
| on the main board | screw terminals 0.5 mm² wires, stranded wires recommended |
| Assembly | plug-in module |
| Board dimensions | 40 x 28 mm |
| Operating mode (single or dual pair wiring) | half duplex |
| Network: | |
| network type | daisy chain |
| cable type | twisted pair |
| line length max. | 1000 m (3000 ft) |
| number of devices | 32 devices on line |
| data speed | 9600 baud max. for DMP248 transmitters |
| operating mode | polling mode |
| common mode voltage range | ±7 V |
| Operating temperature | -40...+60 °C |
| Storage temperature | -40...+70 °C |

# APPENDIX 4

## INSTALLING AND USING THE RS 485/422 SERIAL PORT MODULE

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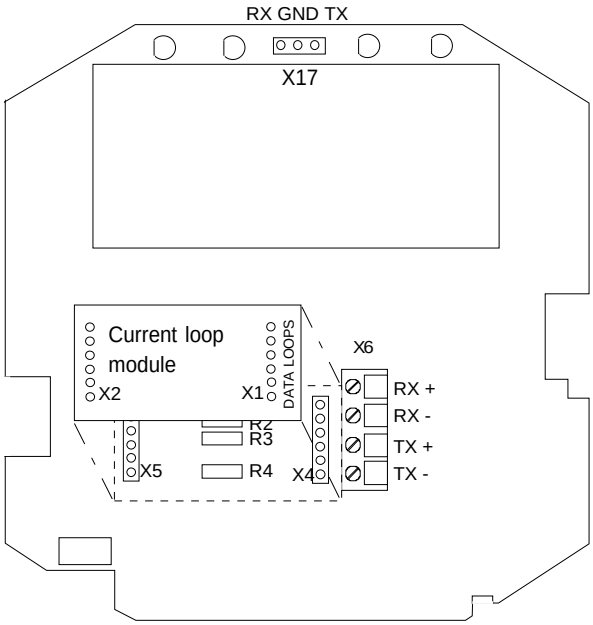
# Installation

Switch the transmitter off.

Resistors R2, R3 and R4 between connectors X4 and X5 in the component board in the cover of the transmitter are removed with side-cutting pliers. The module is plugged in connectors X4 and X5 on the main board of the DMP248 transmitter; connector X1 on the module board to connector X4 and connector X2 to connector X5.




Connect the data wires to screw terminal X6 on the main board. Switch the power on.

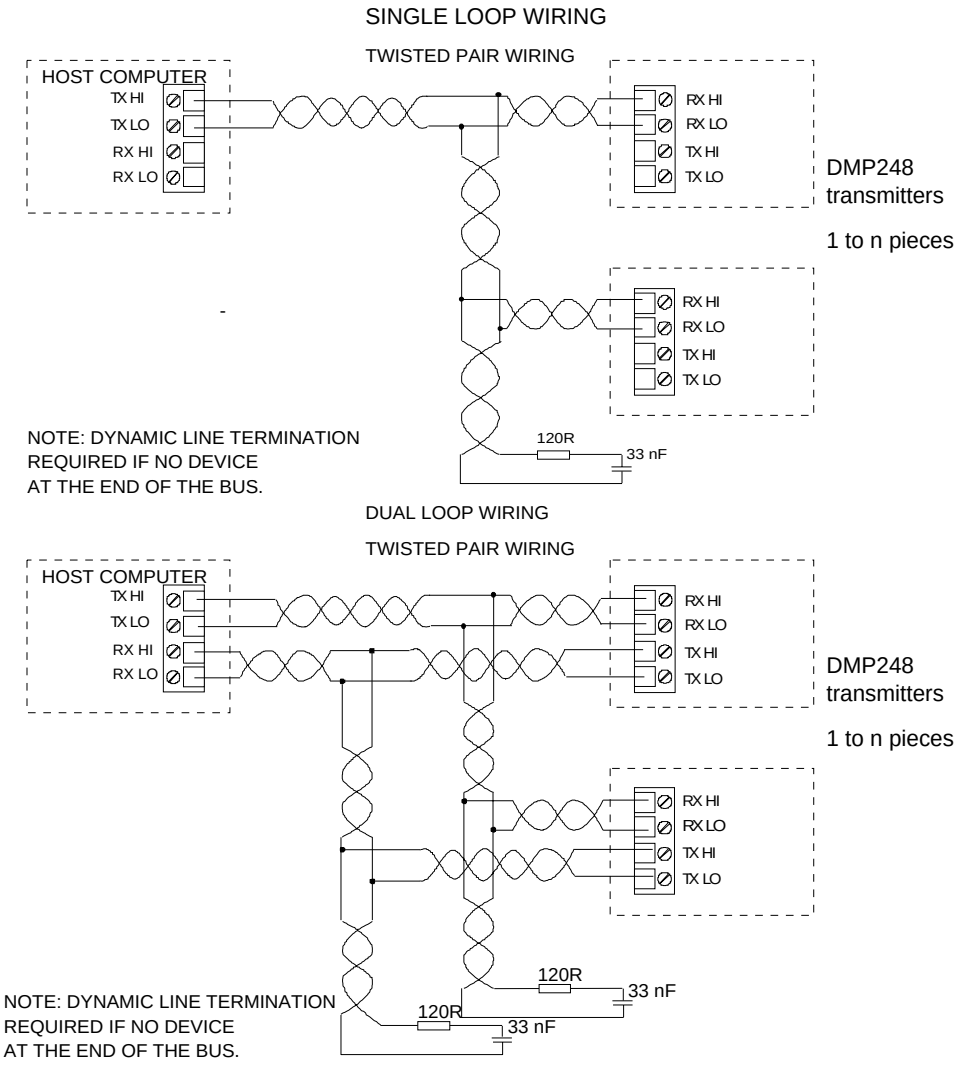
# Operation

The DMP248 transmitters can either be given an address or operated without an address. Both single and dual loop wiring with half duplex connection can be used. No address is needed when only one DMP248 transmitter is used; when several transmitters are connected to the same line, each transmitter must be given an address in the initial configuration.

A current loop must get its operating voltage from the master or it can have its own (floating) power supply capable of supplying 15...40 V and 20...30 mA. Unregulated AC/DC adapter can be used, if the current is limited to 20 mA at least by a serial resistor.

**NOTE** The host computer can restrict the loop supply voltage that can be used; see computer specifications.

The serial line structure is a serial interfaced chain (daisy chain). At one end of the serial line there must be a DMP248 transmitter and at the other end a line master. A branch line can be made with a junction box.




The digital current loop module has separate lines for transmitting and receiving. Both single loop wiring and dual loop wiring can be used (see figure). Dual loop connection makes it possible to have a few more transmitters on the same loop pair. A single loop connection has

simpler wiring. Data transmission is achieved by switching the loop current on and off.

Normally, current flows through the loop(s) even when the DMP248 transmitter is not on, so switching one transmitter off does not affect the other transmitters on the loop.

When the wires have been connected correctly, the voltage drop from RX+ to RX- is below 2 V. If the wires RX+ and RX- or TX+ and TX- are connected incorrectly, the voltage drop from RX+ to RX- or from TX+ to TX- is below 1 V and the transmitter does not work. Even then the current goes through the loop and the other transmitters can be operated normally.

When the loop supply is current limited, the data lines can withstand short circuit to ground and to each other. They do not survive connection of supply voltage to the data lines.

The module must be mounted on the main board in the right direction. It can be mounted in the wrong direction or to the wrong pins without breaking the module; it simply does not work then. Reverse wiring of RX+ and RX- or TX+ and TX- does not affect the module.

# Network configuration

## Single loop operation

Bi-directional data on one pair and galvanic isolation are the advantages of the current loop. Single pair/dual pair use is configured through wiring (see figure).

Supplying power from the same end to the loops prevents crossover voltages.

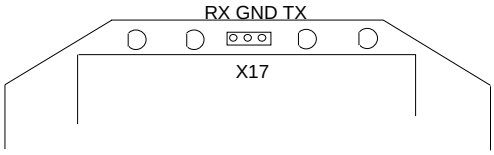
- Connect wires to the transmitter's serial connector.
- Check the wiring.

The following procedure must be repeated with all transmitters.

- Open the transmitter cover.
- Pull out the digital current loop module, if it is already mounted.

- Set the serial port of the terminal to 4800 baud, even parity, seven data bits and one stop bit, full duplex (4800 E 7 1 FDX).

- The serial settings of the transmitter must also be 4800 E 7 1 FDX and the transmitter must be in STOP mode. If these factory settings have been changed, they must be changed back. Connect the RS 232C port of the terminal to connector X17 on the top of the main board and switch the power on.




## Single loop wiring

- Set the address of the transmitter; it can be any number between 1 and 99. In this example the address is 22:

```
>addr 22
Address   :     22
```

- Set the serial bus settings according to your network specifications. This setting will become valid after next RESET or power off:

```
>seri 2400 e 7 1 h
2400 E 7 1 HDX
```

- Set the transmitter in POLL mode:

```
>smode poll
Serial mode   : POLL
```

| **NOTE** | The SMODE command must be given last. |
|---|---|

| **NOTE** | The transmitter outputs no prompt (>) after the SMODE POLL command and it only reacts to commands which include its address. |
|---|---|

- Check that the transmitter responds to its address:

```
send 22
Td= -47.4 'C T= 29.1 'C
```

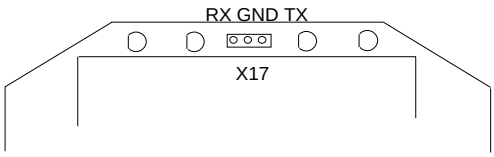
- Disconnect the terminal.
- Remount the digital current loop module.
- Close the cover.
- When all transmitters on the network have been configured, switch them off.

## Dual loop operation

Single pair/dual pair use is configured through wiring (see figure on page 2).

The following procedure must be repeated with all transmitters.

- Open the transmitter cover.
- Pull out the digital current loop module, if it is already mounted.
- Set the serial port of the terminal to 4800 baud, even parity, seven data bits and one stop bit, full duplex (4800 E 7 1 FDX).
- The serial settings of the transmitter must also be 4800 E 7 1 FDX and the transmitter must be in STOP mode. If these factory settings have been changed, they must be changed back. Connect the RS 232C port of the terminal to connector X17 on the top of the main board and switch the power on.



## Dual loop wiring

- Set the address of the transmitter, it can be any number between 1 and 99. In this example the address is 22:

```
>addr 22
Address    :    22
```

- Set the serial bus settings according to your system. This setting will become valid after next RESET or power off:

```
>seri 2400 e 7 1 f
2400 E 7 1 FDX
```

- Switch echo on:

```
>echo on
ECHO    :   ON
>
```

- Change the serial output mode into POLL:

```
>smode poll
Serial mode   : POLL
```

**NOTE** The SMODE command must be given last.

**NOTE** The transmitter outputs no prompt (>) after the SMODE POLL command and it only reacts to commands which include its address.

- Check that the transmitter responds to its address:

```
>send 22
Td= -47.4 'C T= 29.1 'C
```

- Disconnect the terminal.
- Remount the digital current loop module.
- Close the cover.
- Repeat this setting procedure with each transmitter
- When all transmitters on the network have been configured, switch them off.

# Checking the serial port network operation

Normally, measurement readings are asked when the transmitter is in POLL mode; then the command must include the address of the transmitter. If the settings of the transmitter need to be changed, the transmitter is switched to STOP mode with command OPEN; commands can then be given without address. When the line to the transmitter is closed, it returns to POLL mode.

## STOP mode

Open the line to the transmitter:

```
open 22<cr>
DMP 22 line opened for operator commands
```

Transmitter no. 22 is now temporarily set to STOP mode; it accepts commands without address until CLOSE command is given. Individual settings can now be easily modified. Do not open more than one line at a time.

Use command ? to find out the settings of the active transmitter:

```
? <cr>
DMP 248 /1.01
CPU serial nr :  0
Keyboard type :  0
Address   :  7
Output units  :  metric
Baud P D S    :  4800 E 7 1 FDX
Serial mode   :  STOP
Output intrv. :  0 min
Mtim      :  32
Pressure  :  1013.25
Analog outputs
Ch1   0.00 ...  10.00 V
Ch2   0.00 ...  10.00 V
Ch1  ( RH )   lo   0.000 %RH
Ch1  ( RH )   hi   100.000 %RH
Ch2  ( T  )   lo   -20.000 'C
Ch2  ( T  )   hi   180.000 'C
Transducer    :
PRB serial nr :  0
Calibr. date  :  0
```

When the necessary settings have been given, close the line to transmitters (the command closes all open lines):

```
>close
line closed
```

CLOSE command is always given without address. If no lines are open, there will be no response to the CLOSE command.

## POLL mode

If a transmitter has been set to POLL mode, it will respond only to commands which include its address:

```
send 22
Td= -47.4 'C T= 29.1 'C
```

Addresses from 1 to 99 can be used. According to the 20 mA current loop standard, current flows with no transmission on line. A maximum of 6 devices can be connected on same single loop line, but the number can be increased to 9 by using dual loop wiring.

## Current loop settings

| DMP248 settings | single pair | dual pair |
|---|---|---|
| Full duplex/half duplex | HDX | FDX |
| Echo on/off | OFF | ON |

| Terminal settings | single pair | dual pair |
|---|---|---|
| Line feed after carriage return | yes | no |
| HDX/FDX | FDX | FDX |

When terminal is set to general <lf> (line feed) after <cr> (carriage return), the listings will have two line feeds when also the DMP248 transmitters send line feed.

# Specifications

| | |
|---|---|
| Galvanic isolation | 1500 VAC/DC max. (1 min) |
| Loop supply voltage | 40 V max. |
| Loop supply current | 20 mA nominal |
| must be current limited | |
| Operating loop voltage requirement | 4 V/each transmitter (TX+/TX-) on the loop<br>2 V/each receiver (RX+/RX-) on the loop |
| Loop current | 12...30 mA (space)<br>0...2 mA (mark)<br>30 mA max. |
| Connections | Berg sockets |
| on the main board | screw terminals 0.5 mm² wires, stranded wires recommended |
| Assembly | plug-in module |
| Board dimensions | 40 x 28 mm |
| Operating mode (single or dual pair wiring) | half duplex |
| Network: | |
| network type | serial daisy chain |
| cable type | twisted pair |
| line length max. | 1000 m (3000 ft) |
| number of devices | 6 devices on line (single loop)<br>9 devices on line (dual loop) |
| data speed | 4800 baud max. |
| operating mode | polling mode |
| isolation voltage proof | 250 VAC (1 min) |
| Operating temperature | -40...+60 °C |
| Storage temperature | -40...+70 °C |

# APPENDIX 5

## ERROR MESSAGES

**APPENDIX 5 ..... 127**

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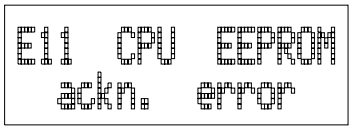
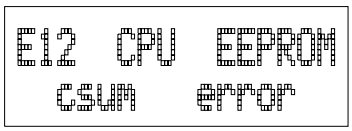
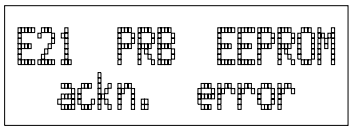
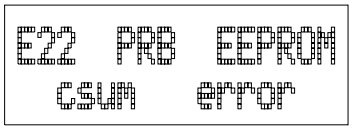
**ERROR MESSAGES**

The DMP248 transmitters go through a self-diagnostics procedure when the power is switched on. When the procedure does not reveal any errors or faults, the transmitter starts operating normally. If errors or faults are found, the transmitter outputs an error message. The error messages can be divided into two groups: error messages after the reset and error messages during operation.

LED symbols:

| | |
|---|---|
| ○ | LED dark |
| ⊙ | LED blinking |
| ● | LED lit |

## Errors after reset

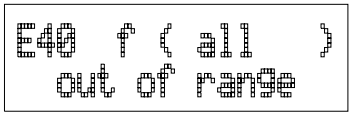
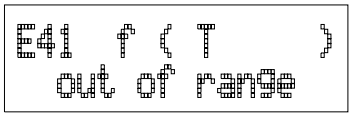
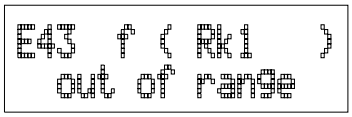
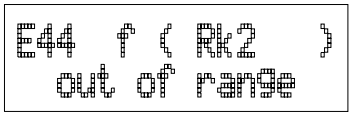
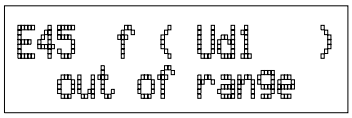
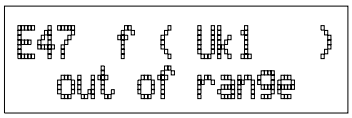
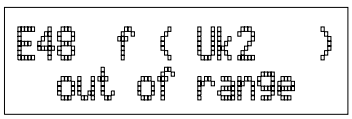
| Display | Serial bus |
|---|---|
|  | E11 CPU EEPROM ackn. error |
|  | E12 CPU EEPROM csum error |
|  | E21 PRB EEPROM ackn. error |
|  | E22 PRB EEPROM csum error |

ackn. error = EEPROM is faulty
csum error = check sum is erroneous
The LEDs display these error types as follows:

| | |
|---|---|
| ○●○○ | CPU EEPROM error |
| ●○○○ | input hybrid error |

## Errors during operation

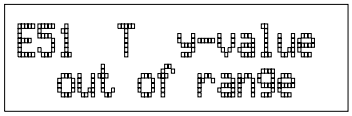
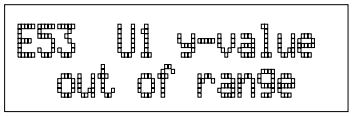
Two types of errors are possible during operation of the transmitters. The first type indicates that no frequency comes from the converter.

| Display: | Serial bus: |
|---|---|
|  | E40 f (all ) out of range |
|  | E41 f (T ) out of range |
|  | E43 f (Rk1 ) out of range |
|  | E44 f (Rk2 ) out of range |
|  | E45 f (Ud1 ) out of range |
|  | E47 f (Uk1 ) out of range |
|  | E48 f (Uk2 ) out of range |

The LEDs display these error types as follows:

| | |
|---|---|
| ○○◉◉ | no frequency at all |
| ○○◉○ | a frequency missing from the RH channel |
| ○○○◉ | a frequency missing from the T channel |

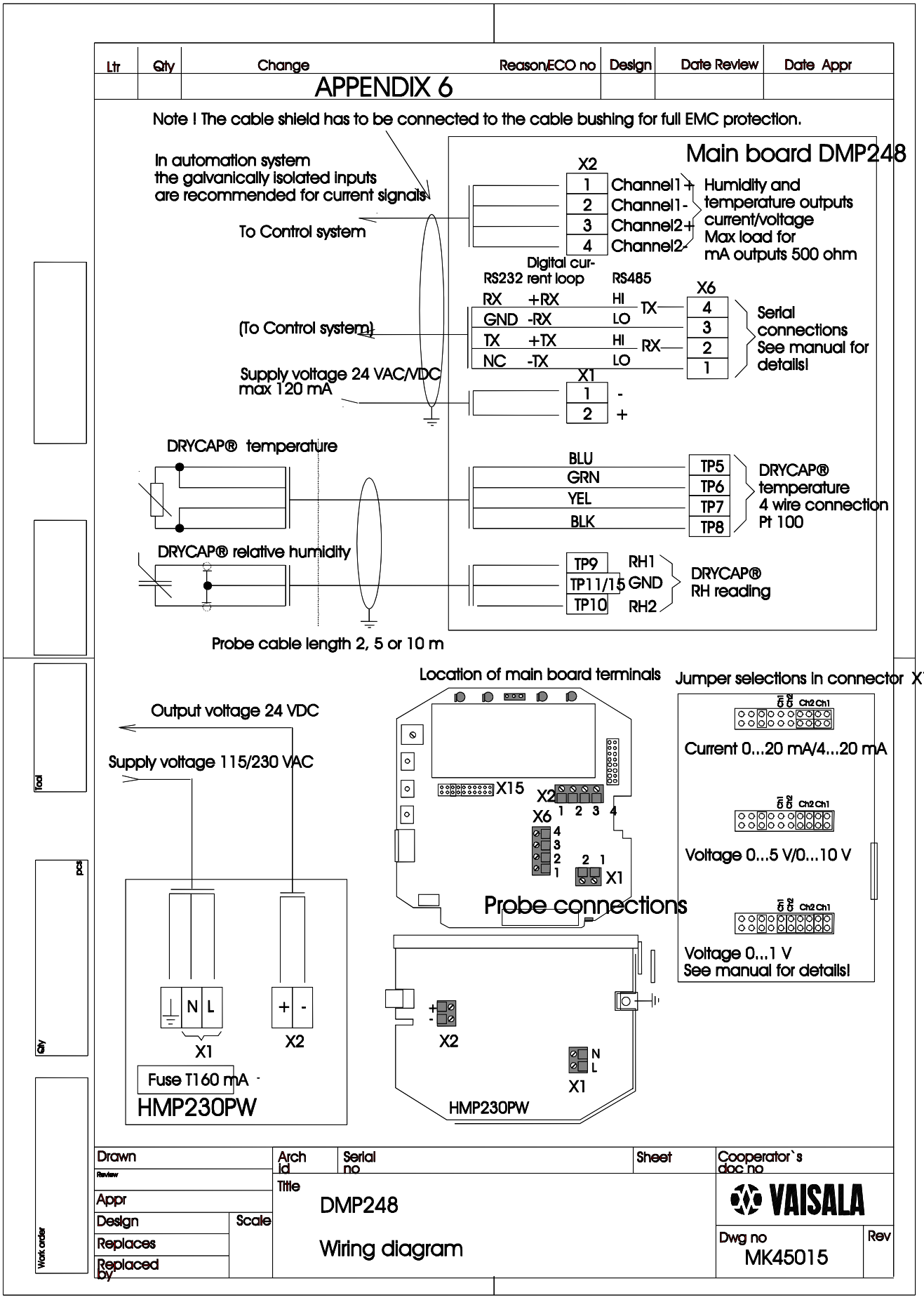
The second error type indicates erroneous y-values (used in internal calculations):

| Display: | Serial bus: |
|---|---|
|  | E51 T y-value out of range |
|  | E53 U1 y-value out of range |

The LEDs display these error types as follows:

| | |
|---|---|
| ◉○○○ | RH channel y-value out of range |
| ○◉○○ | T channel y-value out of range |

# APPENDIX 6


Ltr
Qty
Change
Reason/ECO no
Design
Date Review
Date Appr
APPENDIX 6
Note ! The cable shield has to be connected to the cable bushing for full EMC protection.
Main board DMP248
In automation system
the galvanically isolated inputs
are recommended for current signals
To Control system
(To Control system)
Supply voltage 24 VAC/VDC
max 120 mA
X2
1 Channel1 +
2 Channel1 -
3 Channel2 +
4 Channel2 -
Humidity and temperature outputs current/voltage
Max load for mA outputs 500 ohm
Digital cur-
RS232 rent loop
RS485
RX +RX
GND -RX
TX +TX
NC -TX
HI
LO
TX
RX
X6
4
3
2
1
Serial connections
See manual for details!
X1
1 -
2 +
DRYCAP® temperature
BLU
GRN
YEL
BLK
TP5
TP6
TP7
TP8
DRYCAP® temperature
4 wire connection
Pt 100
DRYCAP® relative humidity
TP9
TP11/15
TP10
RH1
GND
RH2
DRYCAP® RH reading
Probe cable length 2, 5 or 10 m
Location of main board terminals
Jumper selections in connector X15
Output voltage 24 VDC
Supply voltage 115/230 VAC
X15
X2
X6
X1
Probe connections
Current 0...20 mA/4...20 mA
Voltage 0...5 V/0...10 V
Voltage 0...1 V
See manual for details!
N L
X1
+ -
X2
Fuse T160 mA
HMP230PW
HMP230PW
Drawn
Review
Appr
Design
Replaces
Replaced by
Scale
Arch id
Serial no
Sheet
Cooperator`s doc no
Title
DMP248
Wiring diagram
VAISALA
Dwg no
MK45015
Rev
Tool
pcs
Qty
Work order

# APPENDIX 7

## Alarm output unit

The alarm output unit consists of two alarm relays and two opto-isolated outputs (see Figure 1). The relay output 1 is available at screw terminal X1 and the relay output 2 at screw terminal X2. The opto-outputs are activated simultaneously with the corresponding relays and available at screw terminal X5.

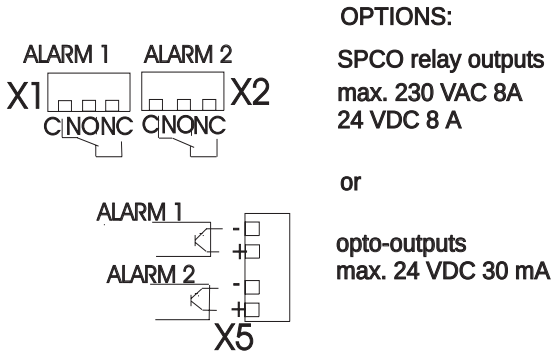



Figure 1 Relay and opto-outputs

When the relay is not activated, the C and NC outputs of the screw terminal are closed. When the relay is activated, these outputs are opened and the C and NO outputs are closed. If required, the relays can be activated by inserting a jumper to the test connector X4. By inserting the jumper to two pins on the left, relay 1 is activated and by inserting the jumper to two pins on the right, relay 2 is activated.

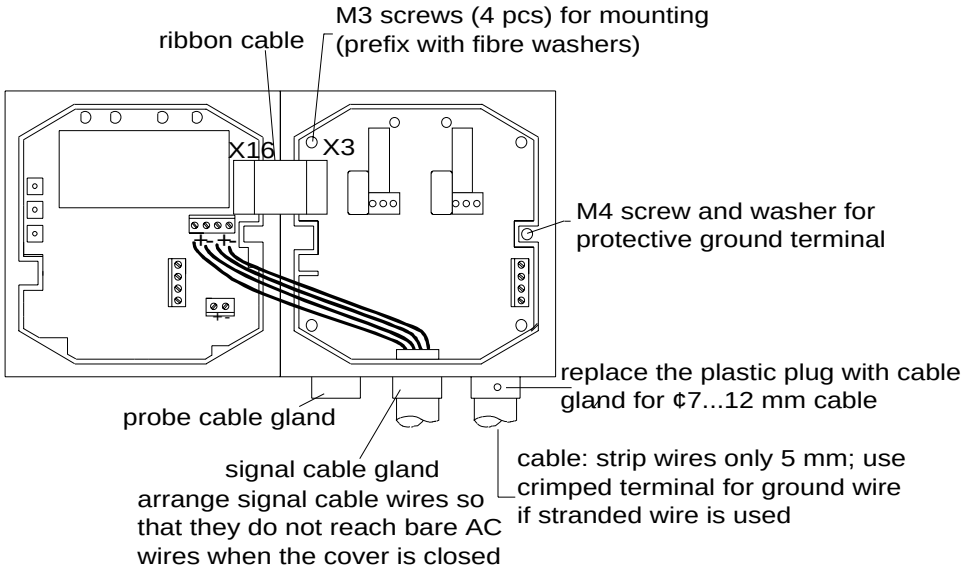
The alarm output unit is delivered with the alarm outputs in OFF mode (not in use). Therefore, the customer needs to set and take into use the desired outputs.

If the mains power is in use, only an authorized electrician may connect the alarm unit. A readily accessible disconnect device shall be incorporated in the fixed wiring (IEC 950).

For alarm output cabling, remove the plastic plug in the transmitter housing and replace it with the cable gland. Fasten the alarm unit to the bottom of the housing with four screws. Attach the grounding wire with the screw and washer to the grounding terminal on the right-hand

side of the module if the mains power is in use. Attach the ribbon cable from X3 of the alarm unit to the X16 on the main board of the transmitter.

| | |
|---|---|
| **NOTE** | NO jumper in connector X4 during normal operation.<br><br>When one alarm unit relay is on, the corresponding LED is lit. |


ribbon cable
M3 screws (4 pcs) for mounting
(prefix with fibre washers)
X16
X3
M4 screw and washer for
protective ground terminal
replace the plastic plug with cable
gland for ¢7...12 mm cable
probe cable gland
signal cable gland
arrange signal cable wires so
that they do not reach bare AC
wires when the cover is closed
cable: strip wires only 5 mm; use
crimped terminal for ground wire
if stranded wire is used

Prefix the fastening screws with fiber washers for mounting the unit to the box.

| | |
|---|---|
| **NOTE** | The alarm unit cannot be used with the power supply unit HMP230PW. |

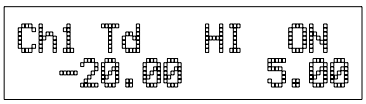
| | |
|---|---|
| **WARNING** | Do not detach the alarm unit from the transmitter when the power is on. |

| | |
|---|---|
| **WARNING** | Do not connect the mains power to alarm unit without grounding the transmitter. |

# Setting and activating the outputs with menu commands

**Disconnect the security lock jumper!**

- Select MORE in the main menu and then ALARM; the following is displayed:




- If the settings need to be changed, press CL:

- the quantity starts blinking; it can be changed with arrow switches, and acknowledged with ENT.

- the third parameter (in this example HI ON) starts blinking. This parameter determines whether the alarm output is in use or not, and when it is activated. Select the output control state with the arrow keys. The selection is acknowledged with ENT.

The options are the following:

- HI ON (the alarm is activated by exceeding the setpoint, the output is in use)
- LO ON (the alarm is activated if the value goes below the setpoint, the output is in use)
- HI OFF (the alarm is activated by exceeding the setpoint, the output is not in use)
- LO OFF (the alarm is activated if the value goes below the setpoint, the output is not in use)

- The setpoint starts blinking (in this example, -20.00); if you wish to change it, press CL. Use the arrow keys to select the new setpoint digit by digit and acknowledge each digit using the ENT key. Using the CL key, you can correct the entry by deleting the digits one by one. When you have entered the whole setpoint, press ENT for the second time.
- The hysteresis value starts blinking (in this example, 5.00); if you wish to change it, follow the instructions given in previous paragraph.

**NOTE** The options HI OFF and LO OFF are used to deactivate the relay outputs e.g. for service purposes.

The settings of the channel 2 are changed in the same way.

# Setting and activating the outputs using an RS line

**Disconnect the security lock jumper!**

**ALARM <cr>**

or

**ALARM n ON <cr>**

where n = channel number (1 or 2)

The currently valid settings of the alarm output unit can be checked with command ALARM:

```
>alarm<cr>
Ch1  RH   LO   OFF    0.00    0.00 %RH
Ch2  RH   HI   OFF  100.00    0.00 %RH
>
```

This is an example of the factory setting (both alarm outputs are in OFF mode, i.e. not in use). The settings can be changed with command ALARM:

```
>alarm    1    Td   HI   -20  5
Ch1  Td   HI   OFF  -20.00    5.00 'C
Ch2  RH   HI   OFF  100.00    0.00 %RH
>
```

When giving this command, first enter the channel number i.e. the number of the alarm output you wish to use (1 or 2). Then select the quantity you wish to have on that channel (Td, ppm, RH or T). The third parameter (HI/LO) determines, whether the alarm is activated when the setpoint value is exceeded (HI) or not reached (LO). The fourth parameter is the actual setpoint value, which activates the alarm. The last parameter is the hysteresis value; it indicates how much the measured value has to exceed or go below the setpoint before the alarm is deactivated. If the third parameter is HI, the alarm is deactivated when the measured value goes below the setpoint with the chosen hysteresis value. If the parameter is LO, the alarm is deactivated when the measured value exceeds the setpoint with the chosen hysteresis value.

When the alarm outputs have been set, you can activate the outputs with commands ALARM 1 ON (channel 1) or ALARM 2 ON (channel 2). Note that you can also activate the outputs when giving other parameters with command ALARM.

Examples of activating the outputs:

with command ALARM:

```
>alarm    1    Td   HI   -20  5
Ch1  Td   HI   ON   -20.00    5.00 'C
Ch2  RH   HI   ON   100.00    0.00 %RH
>
```

with commands ALARM 1 ON and ALARM 2 ON:

```
>alarm    1    ON
Ch1  Td   HI   ON   -20.00    5.00 'C
Ch2  T    HI   OFF   30.00    5.00 'C
>alarm    2    ON
Ch1  Td   HI   ON   -20.00    5.00 'C
Ch2  T    HI   ON    30.00    5.00 'C
>
```

# APPENDIX 8

# Pressure conversion chart

## Multiplication factors

NOTE: conversions from mmHg and inHg are defined at 0°C and for $mmH_2O$ and $inH_2O$ at 4°C.

| FROM: | TO: hPa/mbar |
|---|---|
| **$PaN/m^2$** | 0.01 |
| **mmHg torr** | 1.333224 |
| **inHg** | 33.86388 |
| **$mmH_2O$** | 0.09806650 |
| **$inH_2O$** | 2.490889 |
| **atm** | 1013.25 |
| **at** | 980.665 |
| **bar** | 1000 |
| **psi** | 68.94757 |

psia = psi absolute

**Example:** 29.9213 inHg = 29.9213 x 33.86388 = 1013.25 hPa/mbar